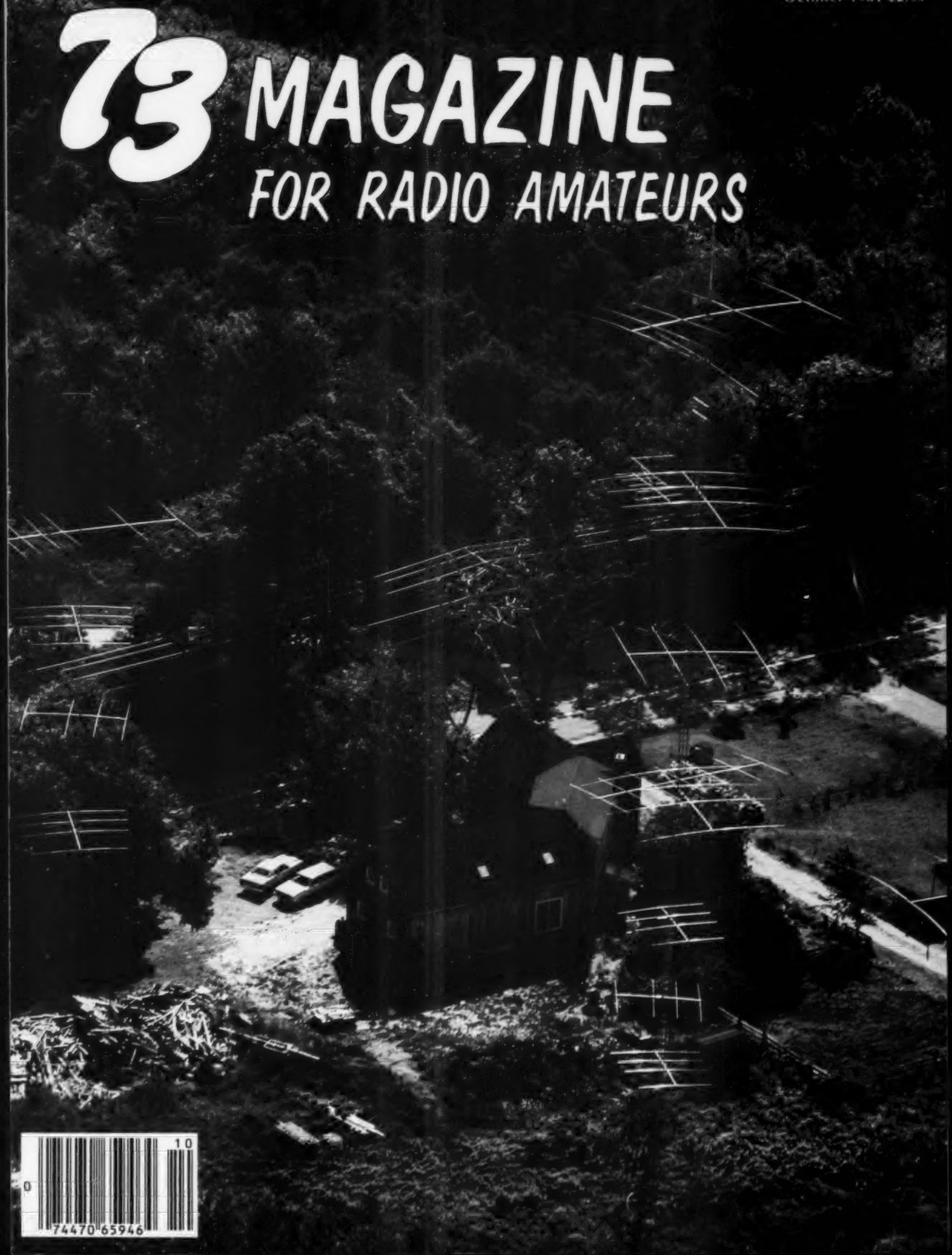
October 1981 $2.95

73 MAGAZINE
FOR RADIO AMATEURS



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Tempo was the first with a synthesized hand held for amateur use, first with a 220 MHz synthesized hand held, first with a 5 watt output synthesized hand held...and once again first in the 440 MHz range with the S-4, a fully synthesized hand held radio. Not only does Tempo offer the broadest line of synthesized hand helds, but its standards of reliability are unsurpassed...reliability proven through millions of hours of operation. No other hand held has been so thoroughly field tested, is so simple to operate or offers so much value. The Tempo S-4 offers the opportunity to get on 440 MHz from where ever you may be. With the addition of a touch tone pad and matching power amplifier its versatility is also unsurpassed.

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With 12 button touch tone pad...$399.00
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13.8 VDC power amplifier...$149.00

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S-30...$89.00* S-80...$149.00*
*For use with S-1 and S-5

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Channel Spacing: 25 KHz minimum
Power Requirements: 9.8 VDC
Current Drain: 17 ma-standby 400 ma-transmit (1 amp high power)
Antenna Impedance: 50 ohms
Sensitivity: Better than .5 microvolts nominal for 20 db
Supplied Accessories: Rubber flex antenna 450 ma ni-cad battery pack, charger and earphone
RF output Power: Nominal 3 watts high or 1 watt low power
Repeater Offset: ±5 MHz

Optional Accessories for all models

12 button touch tone pad (not installed): $39 • 16 button touch tone pad (not installed): $48 • Tone burst generator: $29.95 • CTCSS sub-audible tone control: $29.95 • Leather holster: $20 • Cigarette lighter plug mobile charging unit: $6

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Antenna Tuner

New low profile design.

Here is the famous Palomar Engineers high power tuner in a new compact size. Only 5½" x 14" x 14" yet it has all the features, works from 160 through 10 meters, and works with coax, single wire and balanced lines. And it lets you tune up without going on the air!

WE INVESTIGATED

All tuners lose some rf power. We checked several popular tuners to see where the losses are. Mostly they are in the inductance coil and the balun core.

So we switched from #12 wire for the main inductor to ¼" copper tubing. It can carry ten times the rf current.

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The biggest problem with tuners is getting them tuned up. With three knobs to tune on your transceiver and three on the tuner and ten seconds to do it (see the warning in your transceiver manual) that's 1½ seconds per knob.

We have a better way; a built-in 50-ohm noise bridge that lets you set the tuner controls without transmitting. And a switch that lets you tune your transmitter into a dummy load. So you can do the whole tuneup without going on the air. Saves that final; cuts QRM.

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Cover: K1OX's multi/multi station is a contester's dream (article begins on page 18). Photo by Paul Grupp KA1LR.

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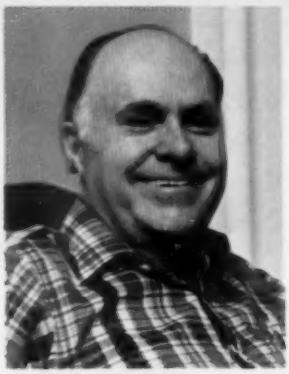
NEVER SAY DIE
editorial by Wayne Green



THE OLD OLD-TIMERS

While talking with someone about the sudden stopping of growth of amateur radio in 1963, when the "incentive licensing" proposal was put to the FCC, I was able to put this situation in better perspective by making a simple calculation.

From the period of 1946 to 1963, a seventeen-year period, amateur radio grew at the rate of 11% per year. This was fairly steady growth. Then it instantly stopped, with a net loss in hams over the next ten years. Since then, it has been growing again, but very slowly. Today, 18 years after incentive licensing was proposed, our growth is only where it would have been by 1965, two years later. We've lost almost a whole generation of hams... sixteen years worth!

Let's put that further into perspective. This means that on the average, hams have gotten sixteen years older. Well, I think we see that at clubs and hamfests. We have a huge proportion of retired hams these days. I think this has a lot to do with the drop in the buying of ham equipment, since retired people are for the most part trying to eke out an existence from Social Security and are in no position to spend a thousand dollars or more for a new station.

We see it also in the drop in the inventiveness of hams. Most retired hams are not up with the latest in technology and are not able to do much to keep up the ham reputation for inventiveness and pioneering... which is a young man's game. We shut the young men out for a sixteen year period, so we don't have many of them any more. No wonder amateur radio has produced so little in the way of innovation in the last 20 years.

The ham inventors and pioneers were, for the most part, youngsters. I was 26 when I got going strong on NBFM and RTTY, running beacons on 6m and so on. Copthorne McDonald was a young chap when he developed slow-scan television. Oh, a few old-timers hang in there, working away. A recent article on Reinhart told about his inventions... well, he was still going strong right up until he died. He wrote articles for *73* in the early 60s. And Bill Hoisington did tremendous UHF developmental work in his 60s and is still going strong in the Philippines. But these up-to-date old-timers are few and far between. Most older hams are still thinking tubes and kc instead of ICs and GHz.

With over one million electronics engineers and technicians kept out of the American work force because they never got into amateur radio, it is no wonder that our country is getting further and further behind Japan in electronic technology. Our hobby and our country are paying the price for that loss of a generation of hams.

If we just want to try to catch up with the growth that we would have had were it not for the incentive licensing disaster, we will have to grow at the rate of 33% per year for the rest of this decade. If we can figure out how to do that, I think that American technology could catch up with Japan. Other than that, I see no serious hope of our country ever regaining our ground.

Should we just shrug our shoulders and give up? Or is this something worth fighting for? This is something which I can't do alone... and which no one of you can do alone. But it is something which all of us together, if we really want to, could tackle and win.

I am not going to butt my head against the wall trying to do something which most hams don't care about. We *can* get amateur radio growing again. We can even get it into a 33% growth pattern... if we really want to. It will mean cooperation and a dedication of purpose which we have not seen in amateur radio in many years. It seems to me that we're going to need to have every ham possible join a club, and see that we get every high-school student we can into our license classes.

In a recent talk with the FCC, I brought up this situation and I believe that our fight may be helped from the highest office... the White House.

My own preference is to tackle the problem with new ideas. I realize that by far most hams are opposed to a no-code ham license, no matter how fantastic this has been for the Japanese... and what great operators they are... and how much this has packed their research labs with enthusiastic ham engineers who are pushing their country ahead of ours. Okay, if you don't want to even think about that... what *do* you propose which could get us growing?

Could we help the FCC by taking over both the teaching and the granting of ham licenses as a function of our ham clubs? This would cut FCC expenses enormously and might bring new life to ham clubs. Hams have always shown that they can be responsible and self-governing. Well, perhaps it is time to take that next step.

What are *your* ideas? Is it worth the bother?

ST. LUCIA

Against my better judgment, we took off a few days and zipped down to St. Lucia. No negatives as far as the island is concerned; it was mostly worry about keeping up with the work load brought on by the introduction of a new magazine: *Desktop Computing*. When a new magazine is being started, there is al-

W2NSD/1 ON-THE-AIR SCHEDULE OCTOBER, 1981

1	15-20 Phone
13	20m RTTY
20	20-40 Phone
27	15-20 CW

Response to our 15- and 20-meter phone sessions has been especially strong, so we have scheduled additional time on these two bands. On both phone and CW nights, look for us in the first 25 kHz of the General portion of each band. We'll be on the higher frequency band first, from 7:00-10:00 pm eastern time.

DF BREAKTHROUGH

Readers should be aware that construction or use of the direction-finding system described in the article "DF Breakthrough" which appeared in the June, 1981, issue of *73* may possibly be an infringement of US Patent #4,041,496, issued to Paul Norris.

Any unauthorized construction or use for commercial purposes of a patented invention is an infringement of that patent. Construction of a single unit for the experimental or personal use of the constructor is not considered commercial use.

Dyna-"mite."

Miniaturized, 5 memories, memory/band scan

TR-7730

The TR-7730 is an incredibly compact, reasonably priced, 25-watt, 2-meter FM mobile transceiver with five memories, memory scan, automatic band scan, UP/DOWN manual scan from the microphone, and other convenient operating features.

TR-7730 FEATURES:

- **Smallest ever Kenwood mobile**
  Measures only 5-3/4 inches wide, 2 inches high, and 7-3/4 inches deep, and weighs only 3.3 pounds. Mounts even in the smallest subcompact car, and is an ideal combination with the equally compact TR-8400 synthesized 70-cm FM mobile transceiver.
- **25 watts RF output power**
  Even though the TR-7730 is so compact, it still produces 25 watts output for reliable mobile communications. HI/LOW power switch selects 25-W or 5-W output.
- **Five memories**
  May be operated in simplex mode or repeater mode with the transmit frequency offset ±600 kHz. The fifth memory stores both receive and transmit frequency independently, to allow operation on repeaters with nonstandard splits. Memory backup terminal on rear panel.
- **Memory scan**
  Automatically locks on busy memory channel and resumes when signal disappears or when SCAN switch is pushed. Scan HOLD or microphone PTT switch cancels scan.
- **Extended frequency coverage**
  Covers 143.900-148.995 MHz in switchable 5-kHz or 10-kHz steps, allowing simplex and repeater operation on some MARS and CAP frequencies.
- **Automatic band scan**
  Scans entire band in 5-kHz or 10-kHz steps and locks on busy channel. Scan resumes when signal disappears or when SCAN switch is pushed. Scan HOLD or microphone PTT switch cancels scan.
- **UP/DOWN manual scan**
  With UP/DOWN microphone provided, manually scans entire band in 5-kHz or 10-kHz steps.
- **Offset switch**
  Allows VFO and four of five memory frequencies to be offset ±600 kHz for repeater access (or to be operated simplex) during transmit mode.
- **Four-digit LED frequency display**
  Indicates receive and transmit frequency during simplex or repeater-offset operation.
- **S/RF bar meter and LED indicators**
  Bar meter of multicolor LEDs shows relative receive and transmit signal levels. Other LEDs indicate BUSY, ON AIR, and REPEATER offset.
- **Tone switch**
  Activates internal subaudible tone encoder (not Kenwood-supplied).

Optional accessories:

- **MC-46** 16-button autopatch (DTMF) UP/DOWN microphone
- **SP-40** compact mobile speaker
- **KPS-7** fixed-station power supply

More information on the TR-7730 and TR-8400 is available from all authorized dealers of Trio-Kenwood Communications
1111 West Walnut Street,
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Synthesized 70-cm FM mobile rig

TR-8400

- **Synthesized coverage of 440-450 MHz**
  Covers upper 10 MHz of 70-cm band in 25-kHz steps, with two VFOs.
- **Offset switch**
  For ±5 MHz transmit offset on both VFOs and four of five memories, as well as simplex operation. Fifth memory allows any other offset by memorizing receive and transmit frequencies independently.
- **DTMF autopatch terminal**
  On rear panel, for connecting DTMF (dual-tone multifrequency) touch pad (for accessing autopatches) or other tone-signaling device.
- **HI/LOW RF output power switch**
  Selects 10 watts or 1 watt output.
- **Virtually same size as TR-7730**
  Perfect companion for TR-7730 in a compact mobile arrangement.
- **Other features similar to TR-7730**
  Five memories, memory scan, automatic band scan (in 25-kHz steps), UP/DOWN manual scan, four-digit LED receive frequency display (also shows transmit frequency in memory 5), S/RF bar meter and LED indicators, tone switch, and same optional accessories.

Specifications and prices are subject to change without notice or obligation.

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most an infinite number of details which have to be cared for. There are the subscription letters, the advertising brochures, the mailing lists, the letters to authors (looking for articles), the quick trips to shows to rustle up more articles and more advertising, the hiring of editors, writers, more graphic arts people, the expansion of our buildings, new typesetting equipment, new presses for the in-house printing, more ad sales people, and so on. Add to that trying to cope with the growth of Instant Software, where ever more people, equipment, and space are needed, plus two very healthy computer magazines which are growing, and the boss, me, has his hands full.

We went to St. Lucia anyway, and it was worth the trip. It was worth it many times over. Firstly, there is no way that I will ever be able to thank the St. Lucian hams enough for their attention, their help, and their interest in making the visit enjoyable. In addition to Sherry, Tim Daniel N8RK of the *73* staff went along, as did Chuck Martin WA1KPS of Tufts Electronics. The ham business was slack in June, so Chuck said what the heck and joined us on the trip.

Though we arrived late at night, we were met by a bunch of the local hams, complete with a cooler full of beer, champagne, and even some soft drinks. It was warm, so the refreshments were a great beginning for our visit. When they offered to drive us to the hotel, that seemed like a good idea...and it sure was. We had no idea that the hotel was on the other end of the island, an hour and a quarter drive over a twisty, narrow pothole road. It was like driving a high-speed obstacle course at night, whipping around deep holes in the pavement every four hundred yards. Fortunately, there is little traffic on the St. Lucia turnpike, which is just two cars wide and goes through mountains just about all the way.

Our hotel, recommended by Eastern Airlines, was a bit of a disappointment. It was wonderfully located, right on a gorgeous sandy beach with palm trees. But the meals were uninspiring. There we were in the middle of a tropical paradise, with fruit at every turn, and the hotel couldn't manage a banana or any other fruit for breakfast. Canned orange juice.

The rooms were clean and some of the air conditioners worked, so I had no complaint about that...nor the ocean

Continued on page 175

Well...I Can Dream, Can't I? **by Bandel Linn K4PP**

"I saw your license plate! There's a traffic jam ahead! Follow me and I'll lead you around it!"

440 SYNTHESIZED

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Jeff DeTray WB8BTH
73 Magazine Staff

Contesting from VP5

— the other end of the pileup and how to get there

It began as a fantasy in August, 1980, and ended seven months and 8,100 QSOs later as a contester's dream-come-true. Tim N8RK had just returned from a week in the Caribbean, where he'd been working with other hams to assist the devastated island nation of St. Lucia to recover from the effects of Hurricane Allen (See "Hams vs. Hurricane Allen," *73 Magazine*, November, 1980). We were examining a detailed map of the Caribbean, discussing his trip, when one of us turned to the other and said, "I wonder which of these islands is rare enough to be a good spot for a DX-pedition?" It was just idle chatter, or so we thought. As it turned out, none of the easily-accessible islands could be considered really rare. However, a couple of places, notably the Turks and Caicos Islands (VP5), were heard less often than most of the others. An idea began to grow. What if we did an expedition? Pretty heady stuff, that! After all, weren't DXpeditions the business of such DX luminaries as Don Miller, Gus Browning, and the Colvins? We set out to prove that a couple of average guys could do it, too.

Our first view of the Turks and Caicos—the tiny island of Grand Turk. Note the airport runway, which runs from shore to shore.

Getting Organized

As with any complex project, proper planning became the key to success. In order to give ourselves sufficient time to bring together the hundreds of details, we selected the first week of March, 1981, as the departure date, giving us a full seven months to organize our trip. This date also coincided with the phone weekend of the annual ARRL DX Competition, in which we planned to enter the multi-operator, single-transmitter category. We still didn't know for sure where we were going, but at least we knew when!

From the outset, planning the trip was an unwieldy exercise in long-distance communication. Tim returned to Terre Haute, Indiana, in late August to continue the pursuit of a degree in electrical engineering, while I remained in New Hampshire. We would not see each other again until March 1st, two days before leaving for VP5-land.

The following seven months were busy, punctuated by long QSOs on 20 meters, lengthy letters, and late-night telephone calls. Tim's acquaintances in the midwest and mine in New England thought our remote-control organizing of such a trip was more than a little unusual, especially since neither of us had ever before been involved in any sort of expedition.

Tim set to work researching the licensing procedures for VP5 and several other countries, while I investigated travel and accommodations throughout the Caribbean. At this juncture, a chance conversation with Joe WB4OSN saved us weeks of work. Joe had visited the Turks and Caicos Islands several times, and he heartily recommended this tiny British possession as an ideal destination for our DXpedition. He spoke with special favor of a place called the Third Turtle Inn, on Providenciales Island (forever after known as "Provo"), one of the largest islands in the Turks and Caicos group. As if this weren't enough, Joe even provided information on air connections to Provo, which was handy, since the commercial airlines do not yet fly there directly from the U.S.A. After educating our

The Third Turtle Inn on Grace Bay, site of our VP5TDX/VP5JDT operation. Built into the side of a cliff, the inn is a popular spot for DXpeditions. We stayed in the small building at upper left.

A partially-completed cinder-block wall provided a sturdy support for our tribander. Here, Tim prepares to hoist the antenna into place on a protruding piece of reinforcing rod.

travel agent on the whereabouts of the islands and getting his assurances that rooms were indeed available at the Third Turtle, the die was cast . . . we were going to VP5!

We soon learned that the Turks and Caicos in general, and Provo in particular, were the home of some of the world's very best snorkling and scuba diving. Throughout the winter of 1980-81, first one and then another skin-diving magazine sang the praises of Provo and the Third Turtle Inn. We decided we had picked the right place.

Meanwhile, Tim was discovering conflicting information on the best route for obtaining our reciprocal operating permits. In fact, we came up with no less than three plausible ways of getting a VP5 license. Fortunately, while Tim's first attempt failed to bring a VP5 license, it did bring the correct information from the Magistrate's office in Grand Turk, the capital city. It was a tight squeeze, however, with our licenses eventually arriving less than three weeks before D-Day. Having these precious documents in hand was a tremendous relief.

It appears that, in the absence of any special request, the Magistrate issues callsigns based on the applicant's initials. Thus I received VP5JDT, while Tim came away with VP5TDX. Applicants who ask for particular suffixes seem to get them, as long as they have not been issued previously.

Details, Details

From the first, every bit of advice that came our way emphasized the importance of careful equipment selection and organization. Coming up short on something as simple as PL-259s could completely ruin an otherwise well-planned trip. The list of required items, from transceivers to suntan lotion, grew almost daily for six months. It eventually occupied seven pages in the small notebook that became my constant companion. In many ways, it was like planning a large Field Day effort, except that the nearest junk box or ham store was 750 miles away.

Early on, we decided to take along a pair of transceivers from the same manufacturer. We reasoned that this would allow us to exchange components in the event of rig failure. It also made all microphones, headsets, keyers, etc., interchangeable without rewiring connectors when going from one rig to another.

In the end, we chose Kenwood gear: a TS-520 loaned to us by good friend Bill W1HCS and an 830S from the OM himself, W2NSD/1. Antennas would be a trap vertical (again courtesy of HCS) and a Cushcraft A3 triband beam. Telex Pro-Comm 200 headset/boom mikes, an MFJ antenna tuner, and a remote vfo for the 520 completed the inventory of major gear.

W1HCS also volunteered his address as the mail drop for the many incoming QSL cards that were certain to follow our trip. Both Tim and I had changed our mailing addresses so often in the past few years that our *Callbook* listings were accurate only in the most recent editions. It may seem like a very minor detail, but the use of a long-established address such as Bill's greatly simplified our on-the-air response to requests for QSL information. Bill's lovely wife, Lynn, accepted this imposition with extraordinarily good grace.

As planned seven months beforehand, Tim arrived in New Hampshire just two days before departure for VP5. Those last 48 hours were spent carefully packing the four suitcases and two antenna bundles which comprised our gear. A fifth bag held all our personal items. The trap vertical and most of the beam were stowed in a red, white, and blue ski bag. Aside from getting us a lot of strange looks in the sunny Caribbean, this proved to be an efficient way to carry those dozens of aluminum tubes. It also had the advantage of sticking out like a sore thumb amongst the piles of baggage at the airports through which we passed; no chance of losing that one. Just in case, however, we decided to carry a minimal station with us aboard the aircraft. On Monday afternoon, March 2, we dashed through our several-hundred-item checklist one last time. Then, it was off to Boston's Logan Airport for a night flight to Miami.

Slowly, Slowly

After seven months of anticipation and a frantic last two days, Tim and I were on a natural high as we flew first to Miami, and the next day, on to Grand Turk, the only place in the Turks and Caicos served by jets from the U.S. We had booked reservations on the Turks and Caicos National Airlines (TCNA) for a connecting flight to Provo, our final destination.

Although the runway at Grand Turk spans the entire width of the island, it's still a short one. Our small 737

Once atop the wall, the antenna was tied off to prevent the ever-present tropical breezes from tearing it to pieces. Kansas is dead ahead.

jetliner used all but the last 100 feet or so in making a smooth landing. After clearing customs and immigration, a task made easier when we showed officials our reciprocal licenses, the first order of business was to check the status of our TCNA flight to Provo. On this matter, there was bad news and good news. The bad news was that the TCNA plane had already departed...without us. The good news was that it had been filled to capacity anyway, so we really hadn't missed anything. Oh, well!

It was quickly obvious that both life and business in the Turks and Caicos ran at a somewhat more relaxed and informal pace than we were accustomed to. We began to explore alternative transportation to Provo and encountered a pilot, an American, who offered to fly us to Provo at no charge, since he lived on the island. The only hitch was that his single-engine plane refused to start, even when jumped from a truck battery. Three hours later, no apparent progress had been made, although our erstwhile pilot was still trying. His only comment was, "Slowly, slowly." We began to wonder if we'd ever see Provo.

The sun was setting behind the Grand Turk control tower when opportunity knocked in the form of charter pilot Howard Hamilton and his beautiful twin-engined Cessna. Howard was bound for Provo and announced his willingness to take passengers if we could leave immediately. Leaving the bulk of our ham gear in the hands of an airport official, Tim and I grabbed the 520, the antenna tuner, some wire, and our cameras and jumped aboard Howard's plane in the failing light. More than an hour later, we arrived over Provo in almost total darkness, at which time Howard executed a near perfect landing without benefit of runway lights or any sort of traffic control. We'd made it.

Faster, Faster

The Third Turtle Inn has played host to a number of visiting hams over the years and has one room which is ideally situated for amateur radio operations. This cliff-side QTH was to be our home for the next seven days. Shortly after our arrival, Tim wandered among the bushes and small trees at the cliff's edge, rigging a very-random wire antenna. The wire tuned up just fine on 15 meters, and we were on the air within minutes.

We had decided to use Tim's VP5TDX callsign during the contest and my own VP5JDT before and after the big weekend. Since the contest was still three days away, it was VP5JDT (with Tim at the mike) which called CQ and worked W2JLO for QSO #1 of our week in paradise. A handful of contacts were made that first night prior to a wonderful seafood dinner and some much needed sleep.

By 1:30 the following afternoon (Wednesday), TCNA had managed to ship the remainder of our ham gear from Grand Turk to the Third Turtle Inn. In between excursions to the beach, we managed to get the vertical on the air, and the pace began to quicken. We settled in for some serious pre-contest operation that continued until 2:00 am, and whichever one of us wasn't working the pileups was bolting together pieces of the beam. We spent time on both modes and found 20-meter CW especially productive.

Things really began to hop when the beam went up Thursday afternoon. The pileups became enormous. As our proficiency grew, so did our contact rate—from 60 to 90 to 150 contacts per hour. Our beam was fixed on the center of the United States, since that's the area we'd be working in the contest. Despite this, a number of Japanese and European stations were worked, mostly as a result of superb operating on their part, especially on CW. About 1500 contacts were made by VP5JDT in the days preceding the contest weekend.

Not that we spent all our time operating. Are you kidding? This was our vacation, too, and we took full advantage of the superb beaches, fine swimming, and delicious food served up by the Third Turtle. When Friday evening rolled around, we were warmed up, rested up, and eager to have at it. At 0000 UTC, we switched callsigns to VP5TDX and plunged headlong into the fray, with KBØPR as the first of 6,300 contest contacts.

The vast majority of the contest is a blur of QRZs, signal reports, and callsigns. However, several highlights, both good and bad, do stand out.

- We made 200 QSOs during the first hour of the contest. Suddenly, we knew we'd be competitive.
- Saturday found us running 10 meters for 8 consecutive hours, averaging 189 QSOs per hour for the duration. The 10-meter propagation was superb, resulting in 2,700 contest QSOs on this band alone.
- Our initial goal of 3,000 QSOs was exceeded with more than half the contest still to go.
- With our adrenalin really pumping, neither one of us did much sleeping during the entire first night of the contest. As a result, we made a lot of mistakes on Sunday morning, and we each fell asleep at the mike at least once.
- We managed 27 contacts on 160 meters, despite the world's worst antenna—a 75' random wire just five feet above the ground.
- Chaos reigned when the 830S gave up the ghost on Sunday morning, blowing a filter capacitor in response to an overvoltage on the power line.
- Only five minutes after the last contact (with KC4IW), our remaining rig, the TS-520, also went down for the count, popping an FET on the rf board. Fortunately, the contest was over, with 6,300 QSOs in the log. We'd averaged 130 QSOs per hour for 48 hours!

The Aftermath

Monday morning found us hard at it, scavenging parts from the 520 to get the 830S back on the air. We succeeded and made 325 more contacts before closing down for good late

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Monday night. WB2RWW was the last of some 8,100 contacts made during our one week sojourn in the Turks and Caicos Islands. All too soon, it was back to reality, and reality was a cold March night in New Hampshire, with a temperature of 35 degrees, about 50 degrees lower than in the islands.

The two of us spent three weeks duping our logs, finding about 300 stations that had worked us unnecessarily. The duping chore was greatly eased by the use of two TRS-80 microcomputers. Our final tally of 5991 QSOs and 4,924,602 points broke no records, but compared quite favorably to the high scores turned in after past contests. We should at least win the certificate for VP5!

QSLing has proved to be a very time-consuming chore. In fact, answering our mountain of cards has required the most time of any single aspect of the whole project. And lest you think DXpeditions always receive envelopes stuffed to bursting with green stamps, be advised that our income so far hasn't even paid for the extra stamps we've had to buy as a result of last spring's 3¢ postage increase. And cards are still arriving, six months later.

It's been debated whether a trip to a pleasant and not-so-rare place like VP5 should be called a DXpedition. Some prefer to reserve that term for visits to more exotic and extremely rare spots such as Spratly Island and Clipperton. But whether you call it a DXpedition, a DX vacation, or something else again, it's a fact that many of the cards we have received bear the inscription, "Thanks for the new country." As we all know, any country is rare if you haven't worked it yet.

A very frazzled WB8BTH near the end of the contest. At this stage, one rig was dead and we had run out of contest log sheets. The sign on the lamp became an increasingly-needed aid to remembering our callsign.

From our viewpoint, the thrill was in being on the other end of the pileup at least once in our lives. It means calling CQ and always getting an answer. It means a QSO rate limited only by how fast you can send or talk. It means finding out just how courteous most hams really are. It means being a celebrity, if only for a little while.

Would we do it again? In a minute! Would we do it differently? Of course; it's always easy to spot your mistakes using 20-20 hindsight. Should you give it a try? By all means! If we can do it, so can you. ■

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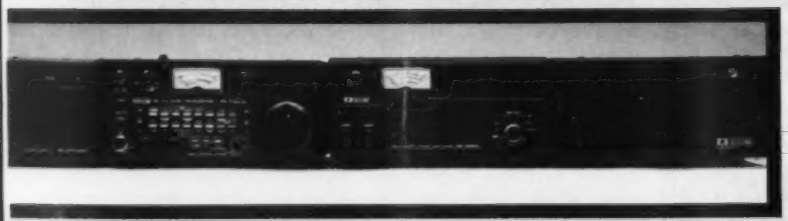

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In Profile: Ted Gamlin, A Contester

Chris Brown KA1D
73 Magazine Staff

In a darkened farmhouse on the crest of a windswept New England hill, conventional time has stopped for 13 men. For them, the hours of the day hold no importance, other than that of marking the approach of sunrise and sunset and the attendant shifts in propagation. This weekend, time is a 48-hour continuum for these men within which they must contact as many DX countries as possible, amass as many QSOs as possible, and do so on as many HF bands as possible. They measure time in the hours of the contest, not of the day.

In their kitchen, dirty dishes, scattered silverware, coffee-stained mugs and half-eaten casseroles litter the countertops like the aftermath of some great feast, but there has been no feasting. Most meals have been gulped in silence and eaten alone. In serious ham radio contesting, there are no communal suppers.

In another part of the house, the contest wing, lights brighten, then dim again, as six Alpha linears bang on and off line. Haggard operators, their voices hinting hoarseness, drive on through the night with their incessant message—CQ CONTEST, CQ CONTEST, CQ CONTEST. The refrain is always the same at Kay One Ocean X-Ray.

K1OX is both man and machine. The man, Ted Gamlin, is an affable and outgoing medical equipment salesman with an extremely competitive nature. The machine is one of the top multi-operator/multi-transmitter contest stations in America and, possibly, the world.

The machine is in high gear this weekend for the phone portion of the 1981 ARRL International DX Contest. With its staff of 13, the big multi/multi contest juggernaut is bullying its way through this contest with a vengeance.

The man has a migraine that won't quit.

Stakes are high, but not in terms of dollars (though Ted Gamlin has spent quite a few in the course of adding five skylight-equipped rooms to his house for the sole purpose of contesting, and has raised six towers and twenty antennas in his backyard). The stakes are high in terms of pride. Put simply, Ted Gamlin and the K1OX machine want to kick

Ted Gamlin K1OX: like a general on the battlefield.

everyone's butt in this contest for the simple pleasure of being the best: the best in America, the best in the world.

Sitting in his darkened kitchen on Saturday night, 28 hours into the ARRL International DX Contest, Ted is putting the finishing touches on an intercom signaling system that will tie the six operating positions of his station together.

Amid the chaos that is big-time contesting, he shares his thoughts with *73 Magazine*.

73: This place is a zoo, Ted! Halfway through the contest and you're still building the station.

Gamlin: Yeah, I might finish it someday, too. It's getting to be a full-time job.

73: Speaking of jobs, what do you do for a living?

Gamlin: I'm in the medical field. I sell blood-chemistry analyzers for a New Jersey-based company called Electro-Nucleonics. And, I've been doing this for about eight years now. Man, time flies!

73: Always been in sales?

Gamlin: No. I started out in field engineering. My background is in electronics and I've got an associate degree. But, when the opportunity came up to go into sales, I just couldn't pass it up. It has worked out pretty well.

I like sales. It's a lot of aggression. I guess that's what life is now. Here we are multi/multi contesting . . . aggression at its best, in ham radio, anyway.

73: Do you do any other aggressive kinds of things . . . play sports for instance?

Gamlin: Yes, I enjoy sports. I play ice hockey in the winter, softball in the summer, and I played football and baseball in school. I generally like aggressive things.

73: Were you into hamming as a kid?

Gamlin: Yeah, I got my license in November of 1961, when I was twelve years old.

73: And how did you get into contesting?

Gamlin: It's kind of funny. It seemed to happen the way most things do in life: One thing led to another. I was living in an apartment, hiding all sorts of wire antennas in the woods next door, and got the urge to get a house of my own on top of a high hill. I had bolted 40 feet of Rohn 25 to my balcony without bothering to ask the landlord—when you ask, they always say no—and it was time to move. I searched for a house and finally found one. Within eight months of moving in, I was contesting. At first I just wanted to chase DX, but friends talked me into contesting because the site was so good.

I never do anything halfway. Towers began going up out in the backyard, and soon I had four. We started contesting and found that we were really competitive. In the first contest we were in, *CQ* World Wide DX, 1976, we used the call W1RR and took third. The next time out we took second place in the ARRL contest. That was in the old house before I added the contest wing. Everything was in two rooms and halfway through most contests the well would run dry. There was always lots of yellow snow around the house in those days. I'm amazed I could get anyone to operate.

73: How about other ham activities? Do you get into traffic-handling or DXing, etc.?

Gamlin: It's funny; I'm seasonal. At certain times of the year, I chase DX like mad and at other times I could care less. It's really odd; my interests are seasonal. In the summer, I don't think much about HF. I play around with VHF on six and two.

73: Have you got any other hobbies besides contesting and playing sports?

Gamlin: One of my hobbies is body-building. I've got a full weight set in the basement and I lift heavy weights. I do the general kinds of things to stay thin and alive and healthy and happy, that's all.

73: And ready to go up towers at a moment's notice?

Gamlin: Well, you know, that's why I started body-building. In the summer, I'm always active. In the winter, I play hockey but don't do any really heavy work. So, for carrying things up towers in the winter, I wasn't always prepared the way I should have been. That's why I started lifting weights in the off-season . . . the off-contest and off-tower-climbing season.

73: What dedication!

Gamlin: Well, I lift my share of weights in the winter and when summer comes I'm ready. It works out very nicely. I think tower-climbing is one of the best exercises in the world. When you climb up, say, 100 or 160 feet straight in the air, it's amazing what it does to the thigh muscles.

73: Sounds like you're one of the few hams who enjoys tower work.

Gamlin: I do. But I try to pace myself. I climb so that I always have enough energy left to get myself out of a pickle should anything go wrong. Nothing ever has yet, although I've been in my share of binds.

Diet Pepsi and visual aides help keep K1OX's ten-meter rate high during a morning JA run.

"I never do anything halfway."

Janice Gamlin: a wife who has learned to live with ham radio contesting.

73: So I understand. There is an anecdote I've heard about the assembly of your 160 footer that's pretty scary.

Gamlin: That's for sure. I built all my towers myself, including the 160-foot Rohn 45. One day, I had climbed up about 130 feet with a 70-pound section hooked to my belt. I was putting on the last few sections without a gin-pole and I said to myself, "Man this thing seems heavy!" I looked down, and the rope left on the ground had looped around another section. I was climbing with 150 pounds of tower sections hanging on my belt. I couldn't let go and I couldn't hang on much longer. The old "What do I do now?" routine.

73: You're crazy!

Gamlin: You're right. Many people have said that, too, including my wife. I've been up these towers in windstorms, total blackness, rain, you name it. I've got stories about what's happened to me on those towers that you wouldn't believe, like the time I got a wrench stuck to my tongue.

73: To your tongue?

Gamlin: Yes, on last Christmas Day. It was about 20 below zero with a wind chill of minus 60. Unbelievable! My lower 20-meter monobander in the stacked array had broken loose in the high winds and was hanging by its truss lines. Before it beat itself to death, I had to go up and secure it. That is the coldest day I've ever been up a tower. I got up to it and just ran out of hands. I put the wrench in my teeth knowing I couldn't touch it with my tongue. But, it wobbled, caught my tongue, and froze to it instantly. There I was, hanging off the tower, freezing to death, trying to pry this wrench off my tongue without giving up too much skin.

73: Speaking of towers, Ted, I've noticed a few around the house. Could you fill me in on the antenna farm?

Gamlin: OK. On 160 meters, we're using a full-size inverted vee. The apex is at 160 feet and the ends are at 90 feet.

On 80 meters, I have a pair a full-wave delta loops in phase. The apex of those is at 160 feet and the bottom legs are about 72 feet off the ground. They are horizontally fed and are on a 42-foot cross-boom. I also have a full-size, 1/4-wave vertical with 98 radials underneath it. It's a Rohn 25 tower on an insulated base. There also is a simple dipole hanging flat-top at about 54 feet and two beverages.

73: That's quite a setup. How about on 40?

Gamlin: On 40 meters, I have a four-element KLM monobander at 95 feet. I also have a two-element monobander at 75 feet which has not been performing very well.

73: And on 20. . . ?

Gamlin: On 20, I've got a rotatable, five-element monobander at 160 feet. Fixed in the European direction, on the same tower, there is a four-over-four array made up of two four-element monobanders. There also is a four-element monobander fixed on the Caribbean on the 20-meter tower. By the way, all these antennas are switched by Transco low-loss remote relays and fed with RG-9/BU, a silver-plated, double-shielded coax.

73: I see. And on 15 . . . ?

Gamlin: On 15, basically the same situation. A six-element monobander at 105 feet, a fixed four-over-four array to Europe, and a single four-element monobander on the Caribbean.

73: And, finally, ten?

Gamlin: On 10, the top antenna is a seven-element, wide-spaced, home-brew monobander at 95 feet. Then a four-over-four array to Europe at 60 and 30 feet and in the middle of that a four-element monobander on the Caribbean.

73: Are most of the yagis home-brewed?

Gamlin: No. The fixed arrays are all Cushcraft Skywalkers and on 20 and 15 the rotatable beams are both KLMs. Only the 10-meter beam is home-brewed.

73: How about the operating positions? Does each have two transceivers and a third, spotting, receiver?

Gamlin: Yes, except for 160. Right now, I'm a victim of everyone else's equipment. Trying to set everything up in three or four hours before a contest is just murder. Surprisingly, we've had relatively few problems so far.

73: About the station, did you build it all yourself?

Gamlin: Mostly. I had a contractor do the big stuff on the new wing I've added and I'm doing most of the wiring and finish work.

73: How about the station engineering? That, too?

Gamlin: Yes. That's the hard part. Inter-station interference can be very tough to get rid of.

On all bands, you have to have suck-out filters that null the second harmonic of each transmitter, plus bandpass filters all over the place. We've found that the Japanese equipment is very susceptible to overload. Great pains must be taken to keep the level of all that garbage down, and especially no broadbanded transmitters. They are the worst.

I'm really happy with the way everything has turned out, though. It's funny. This

thing has sort of evolved. I never had a complete plan from day one. Once the addition was underway, I realized that there was going to be lots of extra room. It was then that I decided to use it for a massive multi/multi. So, I had five separate rooms framed, lots of sound-deadening insulation put into the walls, solid-core doors hung for each room. Did everything to keep ambient noise down. Ambient noise is the enemy of every multi/multi. It kills them.

With the spiral staircase I put in, I'll never be able to take queen-size beds up to the contest wing so I guess they won't make great guest rooms. They sure make good contest rooms, though.

73: Ted, you seem to have the ultimate setup here in terms of the facilities and equipment. At what point does the human take over and make the difference between winning and losing?

Gamlin: At this level, you have to have the best of both, men and machines. As far as the ultimate setup goes, I'm not quite there, yet. I'd like to have all the equipment in place so that the guys could just come in and operate. My objective here is to keep the people operating under optimum conditions, to keep it enjoyable.

Unfortunately, the building drained me financially to the point where I couldn't provide all the equipment needed. In time, I hope to have good quality radios of my own up there in all the positions. Slowly but surely, I'll get everything set up.

73: So, most of the rigs are now brought in by the operators?

Gamlin: Yes.

73: I thought that you had five Kenwood TS-830s ordered for the station.

Gamlin: I did. But, as I say, the building drained me financially and I couldn't supply an 830 at each operating position.

73: Are you pretty well sold on the 830 as the best contest rig?

Gamlin: More or less. I've looked at lots of rigs, and we have lots of different ones here this weekend, and the 830 seems to have the best receiver in it of any Japanese rig I've ever used. In all cases, we run an outboard receiver anyway so Kenwood's problem of receiver overload is minimized. I also prefer tube-type transmitters. They tend to have cleaner audio and seem more able to take the abuse we give them in a contest. At some point in the future, I'll probably have the five Kenwoods.

73: Ted, I must admit I find it a little strange that after all your effort and expense you don't operate.

Gamlin: If I did, I would be constantly interrupted. I would never be able to sit down, uninhibited, and operate because there always would be people saying "Where's this," "I need that," "What's happened, here," "This went dead."

73: Don't you ever miss operating in these big contests?

Gamlin: Not really. I think I feel more pressure on me than all of these guys. Typically, in every contest

CONTESTER'S WIFE—JANICE GAMLIN

73: As we sit here, you've got a house full of contesters. Do you think your husband is a bit crazy for inflicting these madmen on you several weekends a year?

Janice: Not at all. I think it's a lot of fun . . . a lot of good constructive fun. They have all worked very hard this weekend and some are so punchy from lack of sleep they can't see straight. But I don't see it as crazy at all. They are having too much fun for it to be crazy.

73: Ted tells me that you are studying for your Novice license. Is that true?

Janice: Yes, I'm trying to, anyway. I go to class two nights a week and I hope to take the test soon.

73: Any plans to get into contesting?

Janice: Well, maybe. I probably would try it if I thought I wouldn't get in their way. They get a little . . . uh, excited up there during a contest.

73: How long have you and Ted been married?

Janice: A year this past June.

73: And you knew about this contest business before the ceremony?

Janice: Oh, yes. I remember when I first came over to the house, though. I looked at what turned out to be the antenna farm and said, "You've gotta be kidding! Those aren't clotheslines out there."

Ted said, "No, dear, they're not," and then explained it all to me. I never thought that anyone could be so enthusiastic about anything. I had heard of hobbies, but never anything like this. He has it in his blood.

73: I thought it rather unusual that you had a wing added to the house for the purpose of contesting. Ted mentioned something about always having plenty of room for guests. Any comments on that?

Janice: He told me at first that we would have five guest rooms above the new family room and two-car garage. Truthfully, I knew from day one that there was something funny about that, especially when I saw the skylights go in.

Then, Ted told me about the wonderful spotlights he was going to put around the house. He said that they would be pointing up in the air, though, and I asked myself "Why do we want spotlights around the house that point up in the air?" Then it dawned on me: So the contest operators in our guest rooms could see their antennas at night through the skylights!

I went along with the guest-room story until he installed the operating tables, intercom units, and 220-volt wiring. I finally asked him where the guest beds were going, but I knew all along, really.

73: Do you usually have lots of guests around here?

Janice: I mean how many guests can you have at one time? After all, we're not running a motel. Now that I think of it, most of our guests arrive at contest time.

73: Have you met any of the other wives or girl friends of these contesters?

Janice: Well, I have met a couple of wives. That's a problem that I'm up against. The wives of most hams that I've met do not like the hobby; they don't like the people associated with the hobby, either.

Most wives think that because ham radio doesn't bother me and that I'm happy for Ted, that there is something wrong. They look at me like I'm on their (the hams') side. That's a difficult thing, because I sometimes don't know where I fit in. I have felt that animosity and it's no fun.

73: What do you think the problem is? Why don't wives like their husbands' hamming?

Janice: It competes with them for their husbands' time. We have 13 guys here this weekend who are not at home with their wives and families. Ted has been working on his station every night for the past two weeks. That kind of commitment can get to you.

73: But it hasn't gotten to you?

Janice: If I were the type of person who got upset about things like that, I probably wouldn't have married Ted.

	W2PV, 8.43M points		K1OX, 7.8M points		K2UA, 6.94M points	
Band	QSOs	Multipliers	QSOs	Multipliers	QSOs	Multipliers
160m	19	14	13	11	14	12
80m	171	72	141	67	113	63
40m	214	73	253	82	281	68
20m	1525	137	1288	140	1100	142
15m	1773	141	1603	133	1441	127
10m	1300	125	1409	120	1365	127

Fig. 1. Some claimed multi/multi raw scores from the 1981 ARRL International DX Contest.

from Friday night right through Saturday night, I develop a massive migraine headache from the tension. I feel the tension and excitement of running six stations, not just one. I never could sit down and actually operate because I'd be worrying about all the problems that might occur in the other operating positions. I just couldn't give my full attention to what I was doing.

73: You do seem to enjoy being the general on the battlefield, don't you?

Gamlin: You know, it's funny you should mention that. Have you noticed the skylights in the ceilings of the operating rooms? My wife saw me looking out of one the other day and told me that I looked like Patton riding in a tank. I had never thought of that before but it came to mind again when I looked out behind the house at the heavy artillery in the backyard, all those towers and antennas. What a trip!

We'll soon find out if we can win with it. I have put together the best facility I could and I've tried to get the best operators available. Now, it's up to them.

73: Do you have trouble finding operators worthy of the station?

Gamlin: Well, I've got to be choosy, and I import ringers when I can. I try to recruit the best operators I know. It takes special kinds of skills to operate different bands, and the ones necessary on 40 or 80 are much different from those needed on 10 or 20, or even 160. Low-band contesting demands lots of endurance. It really can get tedious after a while.

73: So staffing is a problem?

Gamlin: Not really. Lots of guys want to operate from a big multi/multi. It's the highest category and demands a tremendous effort. But, it takes a special kind of operator for each band.

The 10-, 15-, and 20-meter operators have to be able to handle those high morning rates, to be able to pick calls out the first time and ask for a minimum number of repeats to run them as fast as possible. Those early-morning runs to Europe and Asia are wicked.

73: I noticed that you've got a 10-meter operator who speaks Japanese.

Gamlin: Oh, A1 W1FJ. Yes, he was stationed over there at one point. Those JA runs are another thing. You need someone who isn't intimidated by the little S2 mash of Japanese fellows calling, all running 5 and 10 Watts each. It kills you 'cause you're 20 over 9 to them and they are barely creaking through the noise. It takes guys with ears and stamina who can maintain concentration and handle it for hours and hours. Speaking their language doesn't hurt, either.

73: So you are choosy?

Gamlin: Yes. This station is only as good as the operators behind it, and these guys are great.

73: I'm curious, Ted. What are your goals in contesting, both short- and long-term? What do you want from it?

Gamlin: Obviously, I want to win. I think we have all the artillery here: I think we've got some of the best operators around, the facility is convenient, and the inter-station interference is down to nil. I've covered a lot of ground very quickly and now I want to win.

73: Fine, but in terms of competition, are you looking at domestic stations or are you looking internationally?

Gamlin: Internationally is where I enjoy competing but there are some situations, like NP4A who sits just off the coast and racks up some outrageous scores, that are tough to compete against. He's in a different situation than I and, in a way, a different league.

73: And, domestically. . . ?

Gamlin: Domestically, my goal is to beat everyone else in the states. A guy like W2PV has been at it for years. For me to beat him my second time out with this station would be a phenomenal achievement. Whatever happens in this contest, I'm sure it won't be a runaway. If he beats me this time, it's gonna be a squeak-through and he knows it.

At 9:00 pm on Saturday evening, about half-way through the contest, the

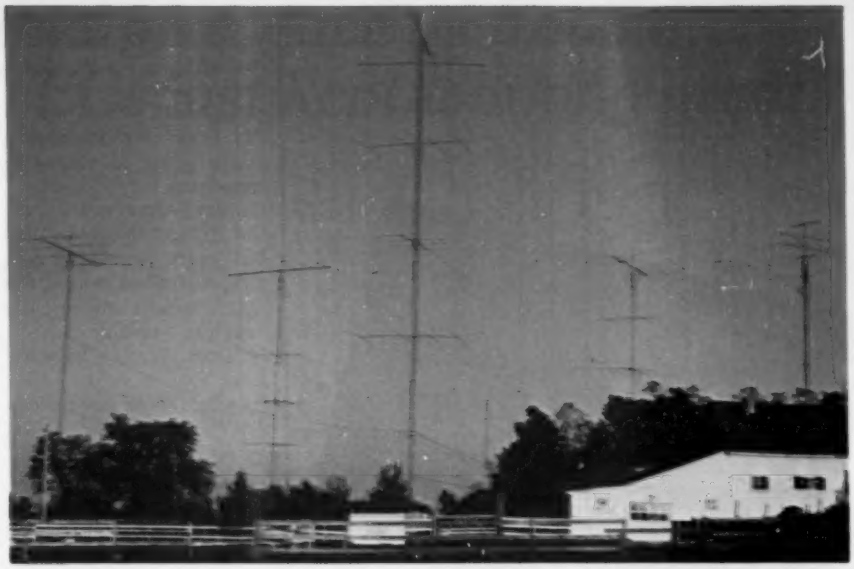
Aluminum, copper, and blue sky over K1OX.

running scores are tabulated. Since each operating position at K1OX keeps a constantly-updated multiplier check sheet for its particular band, interim scores are always available. In addition, each operator keeps track of a "need list" for bands other than his own and arranges skeds for the K1OX operation on other bands with as many multiplier stations as possible. An intercom system ties all the operating positions together.

Though Ted's big multi/multi is doing well, it is running slightly behind its chief rival, W2PV. Ted has arranged to exchange scores with W2PV via a two-meter repeater and, as the numbers come in, it becomes obvious that K1OX is not performing up to snuff on 10 and 15 meters. Behind in multipliers (DX countries), K1OX hopes to make up the deficit in Qs (QSOs).

73: Do you normally exchange scores halfway through contests?
Gamlin: No, this is the first time we've been linked by the repeater. It can be very helpful in picking up multipliers, but not enough guys have been using the machine to its full advantage. We should be hearing about more multipliers on it. I'm going to plunk myself on that mother through the last half, I'll tell you that.

73: Would you rather be ahead or behind at this point?
Gamlin: Obviously, I'd rather be ahead. I always want to be ahead. This is only our second time out, though, and while we've got most of the bugs out, it's still a matter of making the operation efficient, flawless. The station which has the most flawless operation, coupled, of course, with the propagation, is going to win.
73: I guess I was thinking in terms of strategy down the stretch. When they might tend to slack off due to fatigue, is it good for your guys to know that W2PV's numbers were a little better than K1OX's so that they will push harder in the last half?
Gamlin: I took great pains to go into each room and show these guys that we are behind, so there is some psychology involved. I hope it will fire them up.
73: Of course, the competition reports the real numbers... you don't think he's using some psych of his own do you?



What a multi/multi needs in order to be heard in the world of big-time contesting.

Gamlin: No, no. He's telling it like it is. There's no doubt in my mind.

73: Where is the difference in scores coming from?
Gamlin: 10 and 15 are the biggies. We have had problems with one of the radios on 15 throughout the contest which have hurt us. We would be doing a lot better if it weren't for that.

73: How about strategy, Ted? Do you have a scenario which you are trying to follow during this contest?
Gamlin: A strategy sheet would be important in a single-op or multi/single situation. These operators have got to know when to change bands in order to follow the propagation. In a multi/multi, we are on all bands at all times, so it isn't a matter of puzzling out when to be where. Our key is to monitor the propagation on a given band and get a jump on where to have the antennas pointed to take advantage of shifts.

"In every contest... I develop a massive migraine headache. I feel the pressure of operating six stations, not just one."

73: So a multi/multi operation is simpler in terms of strategy than a multi/single or single-operator effort.
Gamlin: Well, in a multi/multi, there is some strategy to consider, but my quys are chosen for their operating strengths on each band.

For instance, Jeff Briggs K1ZM, who is on 20 meters, always has won 20 for me in the past. He's just a great 20-meter operator. He's extremely aggressive, one of the most aggressive of the bunch, though I have some close contenders. I've nicknamed him "Animal."

He's great at holding the frequency and driving other stations off it when necessary. He goes 48 hours straight and never seems to get tired. He always amazes me. I don't know how he does it but, I'll tell you one thing, I'm sure glad he's on my team and he better remain on it in the future.

73: About the future—any big plans for K1OX?
Gamlin: As far as antennas, I could go to longer booms, but the severe weather on this hilltop would cause problems and, in the long run, I don't think it would be worth the grief.

Right now, I have no plans. Well, maybe a seventh tower will go up or another 40-meter beam, I'm not sure. I really can't improve much on what I've got. I'm kind of catching my breath financially, too. I'd like to get some carpets on the floor—that kind of

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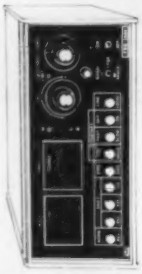

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thing. In general, get everything I already have working right. Oh, yes, and finish these blasted intercom signaling units.

73: I get the impression you're going to stay with contesting.

Gamlin: After every contest, I'd say "Never again." But, every year when contest time rolled around, the fever would strike. It's hopeless, I love it.

73: Does you wife have the fever, too?

Gamlin: Would you believe that Janice is working on her Novice ticket? She goes to class two nights a week.

73: Really?

Gamlin: Oh, yeah, I don't think she'll ever be an avid contester, she's much too nice for that. She does get a kick out of it, though. She loves to entertain and to feed everybody. She is a very special lady. Every day I realize how lucky I was to have stumbled upon her.

Ted Gamlin and the K1OX machine did not realize their goal of winning it all the second time out. As the raw scores accumulated on an 80-meter, postmortem contest net (see Fig. 1), it became obvious that K1OX had not been able to regain the half-million point deficit it had amassed early in the contest.

Ted Gamlin was stoic in his appraisal of the outcome. He simply said, "We'll be better prepared next year."■

The K1OX Crew

160m	Ted Gamlin K1OX
80m	Fred Hopengarten K1VR
	Bob Cunningham K1XR
40m	George Briggs K2DM
20m	Jeff Briggs K1ZM
	Bruce Rusch W1HNZ
	Ken Wolff K1EA
15m	Bill Way W1HD
	John Lindholm W1XX
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	Rex Lint K1HI
	Richard Newell AK1A
	Al Rousseau W1FJ

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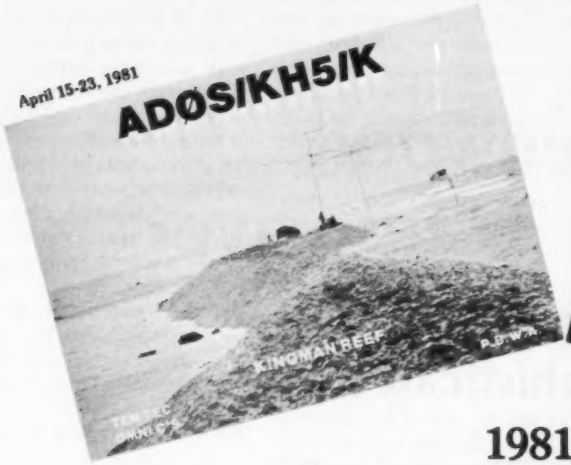

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The Kenwood TS-530S HF Transceiver

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Paul Grupp KA1LR
73 Magazine Staff

When Kenwood announced that the TS-520S was about to be discontinued and replaced with a new model, I was somewhat apprehensive. For many of us, the venerable 520 was an old friend, a perfect example of what an economical transceiver should be—short on bells and whistles, but long on dependability and performance. Would the TS-530S be a worthy replacement? I had to find out, and you just might be interested in what I discovered.

Kenwood's TS-530S.

For those who are not compulsive ad watchers, here is a brief description of the basic features of the new 530. As expected, all amateur bands (160-10 meters) are included. The output stages conform to the *de facto* industry standard for transceivers with tube finals—two 6146Bs and a 12BY7 driver. Both analog and digital frequency readout are provided. The digital readout is the traditional Kenwood blue and displays to 100 Hz; the analog dial is accurate to within a couple kHz. Speech processor, VOX, semi-break-in CW, XIT (transmitter incremental tuning), and full metering are all standard. The receiver section boasts a noise blanker with a variable level control, fast or slow agc, an rf gain control and attenuator, i-f shift, RIT, and a 25-kHz crystal calibrator. Not a bad inventory! The manual is typical of those packed with recent Ken-

wood equipment—good operating instructions and enough schematics and block diagrams to get you into trouble. A complete service manual is also available.

Our 530 arrived in perfect working order, which is somewhat unusual for equipment from almost any manufacturer these days. We immediately installed it in the *73* shack alongside its more expensive brother, the TS-830S. The first thing that strikes you about these two rigs is their similarity. They are built on exactly the same chassis and housed in the same cabinet. Even the rear panel holes are punched in the same place, so the 530 has a few empty spaces where the 830 has jacks.

The similarities between the 530 and the 830 are more than skin deep, however. They share identical final sections, power supplies, vfo, digital readout, and rf boards. Almost all accessories are completely interchangeable, making the 530 a logical choice for a backup rig in an 830-equipped station. Moreover, most of these accessories will also mate with the diminutive TS-130S. Such interchangeability throughout their entire line of HF transceivers is a thoughtful step which might cost Kenwood a few sales of accessories to owners of two or more of their rigs. It will pay off because Kenwood will earn the loyalty of customers who don't wish to replace the entire station each time they upgrade to a new transceiver. Another blow against planned obsolescence!

The 530 is not quite a carbon copy of the 830. In the bells-and-whistles department, it has an audio rather than an rf speech processor, and it lacks the transverter jacks, VBT, tone control, notch filter, and digital hold switch of the 830. On the positive side, the 530 allows both CW and SSB filters to be switched in and out at will. Its big brother only accepts one or the other. Performance? Kenwood rates the 530 receiver's i-f rejection and the transmitter's sideband suppression each 10 dB worse than the 830. All other specifications are the same.

How important these differences are depends entirely on individual operating habits and tastes. Some may miss the extra features of the 830 sorely, but others will balk at spending the approximately 125 dollars more that the 830 costs to get them. One thing's for sure—the 530 has a lot more to offer than the 520 did!

On the Air

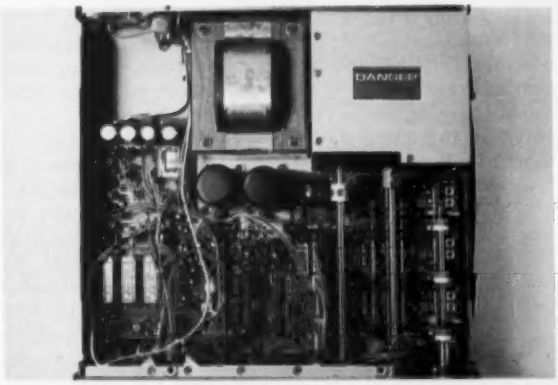
We could talk about features and performance until I ran out of paper and you ran out of patience, but it would all be meaningless if the radio in question didn't "play." The 530 plays! The 530S held a position of honor (front and center on the operating desk) for its entire stay at the *73 Magazine* ham station. One of the things that makes it so successful is the sensible layout of the front panel. Every control has its own knob—there are no concentric controls to fumble with. If you adjust the carrier control, you don't run the risk of messing up the setting of the mic gain control. Nor will you go through an operating session where the band appears to be dead, only to discover that you inadvertently turned down the rf gain control while adjusting the volume! This clean front panel layout should make the 530 an excellent choice for a contest station. Our test was in the summer activity doldrums, so the only contest we could run it in was the Field Day weekend. The QRM, pressure, and excitement were all there, and it performed admirably.

Receiver audio bears the distinctive Kenwood trademark of wide frequency response with a broad midrange peak for added presence, with or without a good external speaker. Hams with good ears who have done a lot of listening to different transceivers could probably pick out the Kenwood every time in a blindfold comparison test.

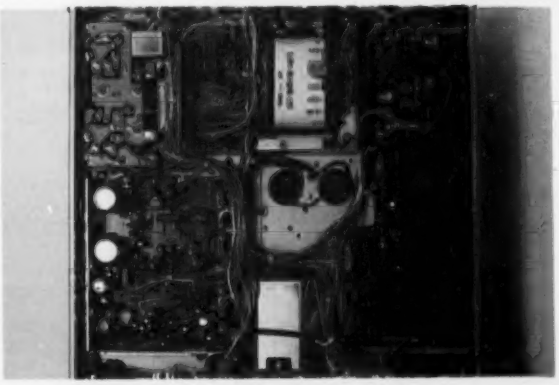
I was very pleased at how easy the 530 is to tune up. I generally prefer solid-state finals, but the 530 is so easy to tune that I didn't mind a bit. Complaints? A particularly rabid CW operator (AG9V/1) felt that the 500-Hz filter didn't have enough ultimate rejection. On the other hand, it is well known that he is hopelessly attached to the 250-Hz filter installed in his S-line at home!

Conclusions

What constantly surprised everyone here who used the 530 is how well it fares in comparison to Kenwood's top-dollar flagship, even though they are not necessarily designed to compete. The TS-520S would not compare as favorably, even though a digital-readout-equipped version retailed for quite a bit more than the 530 does! Kenwood has a worthy successor for the venerable TS-520S, a successor that has a lot to offer at a reasonable price. For more information, contact *Trio-Kenwood Communications, Inc., 1111 West Walnut, Compton CA 90220.* ■



Top view of the TS-530S.



Bottom view of the TS-530S.

Sam Rappold WB6ZYK
PO Box 4678
379 Briceland Road
Redway CA 95560

Folded Unipole for 160

—Top-banders, take notice! Here's a top-loaded radiator with the government's seal of approval.

The more you consider and study antenna phenomena, the more you become fascinated with the flow of ideas about radiation devices and their possibilities. Here is just one such interesting antenna type along with its development, which occurred step by step using a lot of published antenna information and much on-the-air discussion and revelation.

This is an uncommon but very effective antenna type that could interest most low-frequency hams. Zoning height restrictions are admittedly something else, though this antenna idea works well at even a 35′ height restriction. It works somewhat better at 70′ to 130′—and even to 200′ if you can arrange it. And, conveniently, it fits most real estate situations. So, it isn't necessary to miss out on the fun of 160-meter operation because you don't have room for a full-sized horizontal antenna.

Now, short antennas have been proven less efficient than full-size resonant antennas even though the former often provide fair to good communications on occasion. The top-loaded folded unipole (TLU) is a form of shortened antenna that is constructed by folding down the vertical portion to achieve low resonance (because of some height limitation), while increasing resistance and bandwidth and retaining most of the properties and benefits of a high radiator (see Fig. 1).

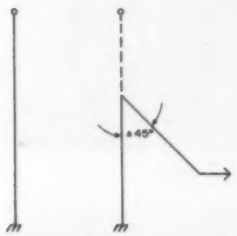


Fig. 1. Basic folded vertical.

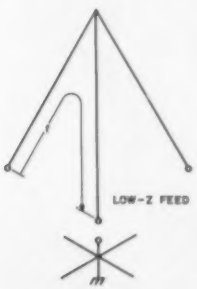


Fig. 2. Series umbrella.

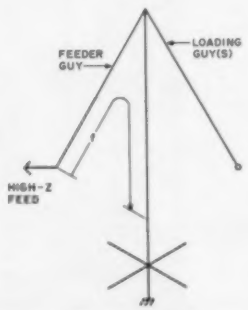


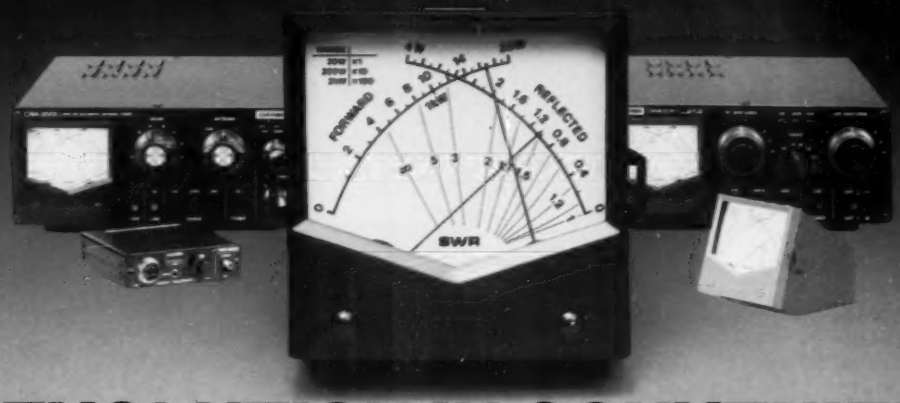
Fig. 3. Grounded umbrella.

Lots of hams have existing towers, poles, trees, or buildings from which to hang this efficient, effective, broadband, and easy-to-use-and-adjust antenna. And, happily, this is a low-cost way of getting up a really good low-band radiator—a real problem for most hams on city-size lots; a 30′ to 50′ TV push-up mast works well in this configuration.

The TLU is just one of many types of vertical antennas. It uses top feed and loading, which gets the antenna current up in the air where it belongs for maximum radiation efficiency. It differs from the series-fed vertical (Fig. 2) that is fed at the bottom, and is coil-loaded at the bottom, center, or top. The TLU is similar to the "umbrella" vertical that is grounded (Fig 3), then fed at the top via the sloping guy wires which come down near to the ground adding length to the system and thus lowering the resonant frequency while simultaneously feeding the antenna. This TLU gives considerably higher impedance to the antenna structure than does the series- or gamma-fed vertical (Fig. 4), a most important consideration. The TLU is a grounded vertical structure (Fig. 5) that is simple, follows the basic engineering principle that simplest is best, and easiest. This antenna is remarkably free of bugs.

This article covers my application of the radiator designed by the U.S. Navy at the Corona, California, antenna range for ship and shore use. Navy Captain Paul Lee (ex-K6TS) describes the principle of the antenna type in his book, *Vertical Antenna Handbook*, pp. 28-31, published by CQ.

It is a very low-angle and broadband vertical. Mine has a 400-kHz bandwidth and I have worked the world with it on 160. It also performs very well on 40 and 80 at a 70′ height. On 160, this vertical (at 70′) tunes with either just a series variable capacitor (when the resonant frequency of the entire structure is 3/8-wave, 160′ to 200′ total) or by adding a coil to ground the feedwire with a ceramic rotary switch, forming an L network. This may be necessary with various antenna heights, volumes, grounding systems, etc., and is required on 40 and 80 to resonate the structure.



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Leading the way in convenience is the Daiwa CNA-2002 2.5 kW (PEP) Automatic Antenna Tuner. Cross-Needle Metering and optimum matching in under 45 seconds make it the perfect compliment to any state-of-the-art amateur station.

Frequency range: 3.5-30MHz including WARC bands • **Tuning Time:** less than 45 seconds • **Power rating:** SSB - 2.5kW PEP, CW - 1kW (50% duty), AM - 500 watts, RTTY, SSTV - 500 watts • **Output Impedance:** 15-250 ohms (unbalanced) • **Dummy Load:** 100 watts/1 minute (installed) • **Metering Ranges:** Forward power - 20/200/2000 watts, Reflected power - 4/40/200 watts, SWR - 1:1 - infinity • **Power requirements:** 11-16vdc @ 200ma

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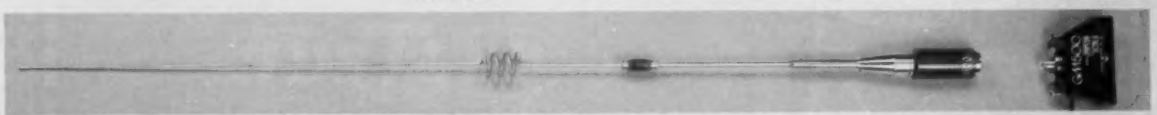

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GM500 - Frequency Range: 1.8MHz-500MHz • **Power Rating:** 1kw • **Dimensions:** 86W x 54H x 37D m/m

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The structural basis for this TLU vertical is a grounded metal tower, tree, pole, building, or wood tower of from 30′ to 200′ in height for the 160-meter band, but should be as high as possible to reduce losses and to lower radiated wave angles. We can't always have a tower of optimum height for one reason or another, but a most effective radiator can be achieved with this TLU principle.

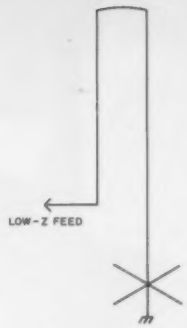

Fig. 4. Gamma feed.

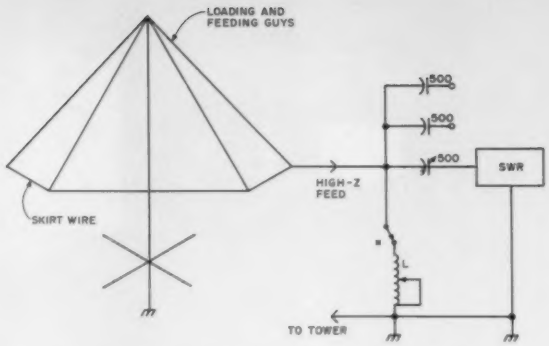

Fig. 5. High-Z umbrella (top-loaded folded unipole, or TLU).

Height, tuning, and loading can vary considerably with a TLU for efficient, effective performance and ease of adjustment. This radiator is simply a big, grounded, closed-loop, similar to any folded antenna, of up to a full wavelength in circumference, much like a grounded quad or triangle. The sloping (and loading) feeder and top guys descend at just under a 45° angle. The sloping line thus becomes part of the radiating portion of the antenna itself, much like the (higher-impedance) "umbrella" vertical that is fed at the bottom (series feed). In both cases, the top guy(s) bonded to the tower top increase the radiator's length and lower the antenna's resonant frequency.

The feedline (and any top-loading guys) descend to guy posts (trees or other guy anchors) at about ten feet above ground. Any guy angle higher than 45° introduces horizontal components into the radiated signal. The higher angle may better suit the purposes of those hams seeking higher-angle coverage for close-in contacts of under about 1000 miles. For serious DX work (low-angle radiation) a less-than-45° angle is a must. Further, the TLU has a considerably higher impedance than the series-fed vertical. Top-loading guys, long used by commercial and military stations, raise the impedance to over 50 Ohms, a highly important and desirable factor. Resonating the antenna of course increases radiation efficiency. Q of the TLU is low—the bandwidth is about 200 kHz with only one feeder-guy. With 4 or 5 such loading guys, bandwidth is near to 400 kHz on 160.

The vertical portion of the antenna (a tower) can be simulated by hanging a grounded wire from any of a variety of structures (trees, buildings, etc.) and the feeder wire brought down at the 45° angle. A tower with beam atop simply becomes a more top-loaded vertical, the beam(s) increasing "top-hat" capacitance loading and further lowering resonant frequency. All this, in combination with some sort of ground system, has proven to be a top performer on all three of the low bands.

Vertical polarization has consistently proved to be optimum over the years under all sorts of propagation conditions on frequencies below about 8 MHz for more than, say, about 3000 miles. Any horizontal antenna on 160 meters would have to be about 130′ up (1/4-wave) for consistent, effective DX work beyond about 3000 miles. This is obviously not an easy height to attain in urban areas, consequently, the desirability and need to go vertically. This TLU is not only a top performer on the lower frequencies but is a very uncomplicated structure.

Inasmuch as the high-current portion of an antenna does most of the radiating, get current up at the vertical's top. In the TLU, the drooping and radiating guys do this current raising well even when the vertical tower is not very high, but, of course, the higher the better (up to 5/8-wave high). A top-loading coil in a coil-loaded vertical is a lossy device and acts like an rf choke, though the coil-loaded and series-fed vertical can be very effective within its narrow bandwidth of 15 to 18 kHz on 160 meters.

It is, of course, a bit of a chore to have to run out in the back yard to adjust the base-matcher in the cold, wind, rain, sleet, snow, and maybe trip over lawn furniture, etc., or fall into the swimming pool in the dark (160 being a nighttime band), not to mention mosquitoes, stray dogs, etc. This, to me, seems to be the hard way to QSY beyond that 15 to 18 kHz and still keep your solid-state finals happy (low swr). Besides, by the time all this has happened, any DX pileup has gotten bigger and deeper. Imagine operating in a contest this way, all over the band—all night.

This TLU is a real convenience and can be adjusted right beside you in the shack. While any artificially loaded antenna is a compromise, this wire-loading using folded-down sloping and radiating guys is a least-lossy compromise. This configuration becomes a sort of multiple-sloper, and acts as a 2-element driven array with maximum radiation (and some gain) along the tower-to-guy axis.

These guys descend to a point about ten feet above ground to where they are secured to guy posts, trees, etc. These guys are bonded to the tower top, and continued down the tower, bonded to the tower every few feet, down to ground level to be bonded into the grounding system—fencing, metal well-casing, etc. Connect these to the shack ground, radials, screen, etc., to complete the circuit and minimize losses which will make the system more broadbanded. These guy wires and/or feeder are tied together at the guy posts' level by a skirt wire which further adds capacity to the structure and feeds directly into a matching network. See Fig. 5.

I feed this antenna not from a gamma match device at the tower top as recommended by the developers, but from the skirt wire as it passes near the shack window about ten feet above ground. It is fed directly using an swr bridge through a series-variable capacitor (about 500 pF)

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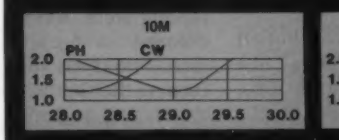

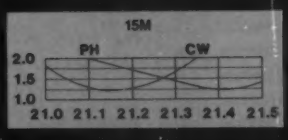

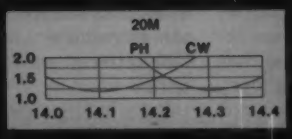

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All this has raised my signal by three S units on local and long DX contacts. The swr bridge is grounded to the station ground system and is connected by heavy cable to the grounded tower, all of which forms that big grounded loop. Spacing of the tuning capacitor plates of the matcher can be of the receiving type for power up to 200 Watts dc input. The higher impedance of the antenna makes it more flexible and easier to adjust.

The grounding system of a vertical radiator performs like the other half of a balanced antenna. As with most vertical radiators, the ground system is indispensable in balancing the system properly, fully grounding the vertical, and increasing conductivity of the soil or ground plane as much as possible to reduce losses and to bring down the angle of radiation. The grounding system may consist of only one ground rod, particularly in circumstances where there is not access to even a tiny patch of soil ground, but the grounding system should be as extensive as possible.

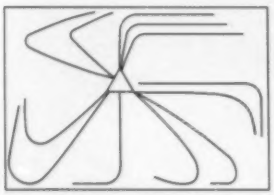


Fig. 6. Radial installation.

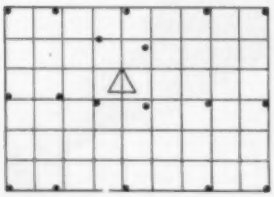


Fig. 7. Ground screen and ground rod installation.

The first step in establishing a ground system is usually to install one or more ground rods, then add as many quarter-wave radials as possible to the tower, up to about 120. Some antenna experts claim that radials do not have to be any longer than the physical height of the tower, and do not necessarily (and ideally) need to be laid out symmetrically similarly to a fan or uniformly-spoked wheel. Also, that it is better in the case of a less than 1/4-wave vertical to have, say, 20 1/8-wave radials than to have 10 1/4-wave radials.

I am on a city lot, 50′ × 100′, with the tower in the exact center of the lot. I've "copper-plated" the entire lot with 51 82′ radials (0.15λ on 160) spread out as symmetrically as possible and curved around clockwise to fit onto my lot (Fig. 6) Then, covering the entire lot, is a 3′ mesh ground screen laid down over the buried radials—under the house, garden, and unpaved driveway! Oh, what a job! But the results make it all worthwhile to the striving, resourceful, dedicated ham.

The wires become invisible when they sink down in the earth from the original burial depth of 1″ to 2″ to more than 6″ after the first rains of the season. All of this was secured to the ground by 14 ground rods strategically placed (Fig. 7). Four more rods were put down around the tower ten feet from each other and from the tower. Old iron pipe (4′ lengths) will be quite adequate.

To extend this ground plane as much as possible within my circumstances, I even stapled four 135′ radials to the side of my wood-frame house. I put them just a few inches above where the cement foundation joins the wooden house siding, a few inches above ground, and spaced them about 2″ apart. These also could be put up under the house eaves. The idea is to make that ground plane as extensive and dense as possible. All this means longer DX paths and contacts for your signal. The rig will load and perform better, too.

There are those experts who claim that an extensive ground system will add nothing to the receiving capabilities. But it has been my experience that after the ninth radial was put down I suddenly began hearing DX that I had not been able to hear before and that DX which had been regularly heard before became clearer (less "watery"), more distinct, and stronger.

Some have even buried large masses of metal like old car bodies, copper tubs, tubing, pipe, metal mats, fencing, etc., obtained from a junkyard. And, of course, connect to your lawn sprinkler system (and maybe that of an obliging neighbor), metal water pipes, and fences. I have worked hams with radials laid in their swimming pools or put down a well casing who get top results even though the antenna theorists belittle such ground systems.

Try studying your situation at length, be adventuresome and imaginative, and you may well surprise and delight yourself with the results, as many of us old-timers have. So in spite of what the experts say about grounding systems, just get down whatever metal you can. There is a great deal of testimony and evidence about the validity of these grounding ideas. Every little bit of buried metal will pay off.

My "loop" is approximately 3/8λ wave in circumference, tuning fully with only a series capacitor of 1500 pF total. For larger or smaller "loops," an L network may have to be formed by switching in a coil from feeder wire to ground as shown in Fig. 5.

This also will have to be done on 40 and 80 meters to resonate the TLU to those bands. The coil should be tappable, mine is 50 turns of #16, 2″ diameter × 5″ long. Or, try using your commercial tuner of whatever type. I have successfully used pi and parallel networks as well. This will give a 1:1 swr across the entire band. With my feeder plus four top-loading guys and skirt wire, the bandwidth is excellent, as shown in Fig. 8.

I have tried various gamma-feed systems with this TLU with only fair results. The on-the-air reports were materially increased (3 S-units) both locally and on far DX by feeding the skirt wire rather than using a gamma-feed. The bandwidth becomes more than doubled with the same structure, which gives still better overall performance.

Even though an antenna can be properly matched and loaded, that antenna may or may not radiate the rf at desired angles. By folding down and, in a sense, diminishing by about half the vertical structure, this TLU method does not seem to materially degrade low-angle performance of a vertical antenna. Further data

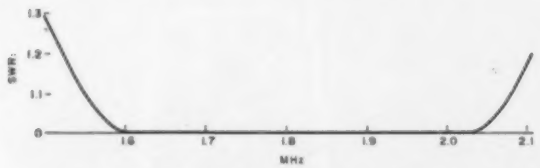


Fig. 8. System bandwidth.

may confirm this.

I keep large maps of the northern hemisphere and of the great circle on the shack wall beside me, and place colored-headed dressmaker's pins on the maps when contacts are made on 160 to record and check performance of my radiated signals. Interestingly, it became very evident that in the directions along the tower-to-radiating guy axes the transmitted signal is maximum, with various diminished reports from between those axes. Consequently, it would no doubt be a more uniform signal pattern if up to 12 nearly equally-spaced top-radiating guys were installed in order to better cover the entire 360°. I have yet to try this.

Utilizing wood towers, poles, buildings, trees, etc. (Fig. 9), from which to hang a TLU, makes for an unobtrusive antenna, especially when a tree is used, which largly hides a TLU. This antenna also can be hung from a building of suitable height or between buildings if necessary. This TLU has proved over the years by many to be a flexible and most worthwhile antenna, and its only limitations have occurred whenever the band is not open (long skip) to my area.

It is an effective DX-getter when the top band is open. Further, this is not a noisy receiving antenna as are most solely-vertical antenna structures. This is probably because of the 40° slanting guys, which pick up less noise (which generally is vertically polarized, thus readily flooding into a vertical.)

Whatever remnants of noise do get picked up are cut out with audio filters plugged into the output jack of the transceiver. So, I am hardly even aware of QRN. (See my article in *73 Magazine* for February, 1980.) Besides, I like to use this TLU structure for receiving because there is 900' of wire and metal surface up there in the air which seems to capture more wave-front energy than do the low receiving antennas of several types in use here. QSB does not seem to be as critical, either, as when using those low receiving antennas, perhaps also for the same reason (sloping feeder and guys).

In considering antenna performance in the case of 160 meters, there is the tendency to pass judgment quickly after only a short trial, giving a false or incomplete impression of actual performance potential, particularly under "closed" band conditions, and not being mindful of the variations—highs and lows of propagation conditions. Receiving and radiating phenomena should be observed over a sufficient period—a week or month—to allow for the inevitable change in propagation

At times I have wondered if any of my rf was going anywhere, but because I waited to make structural changes for some reason (weather, no time, or being just lazy), propagation conditions would change, the 160 band would suddenly open, long-skip DX would come roaring in as occasionally happens on 160, and my calls were answered with big signal reports. The antenna would thus be vindicated and saved from unwarranted changes.

So, do yourself a big favor and be slow of antenna judgment on 160, a band of continual amazement, confoundment, and strong personal reactions. And another thing: On 160, those "openings" can be greatly selective, occurring only in some areas of any given state or region. There is also the "pipeline" phenomenon to be considered.

After more than 50 years of ham radio and watching variations of band conditions on 160, it becomes apparent that conditions vary very widely even during a single hour of nighttime consideration. This type of grounded antenna (TLU) has been a fine if not outstanding performer, and is well worth trying.■

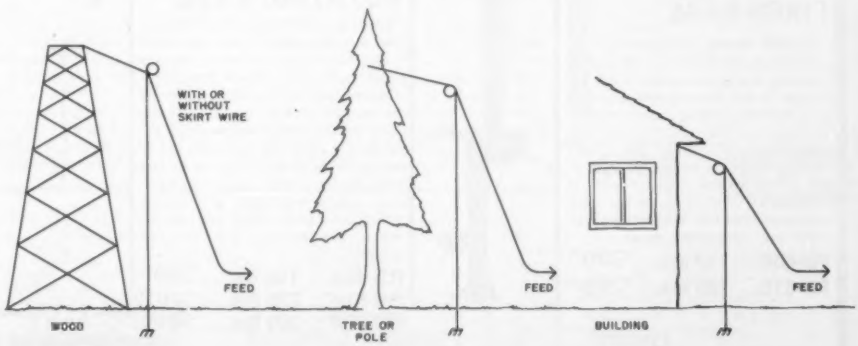
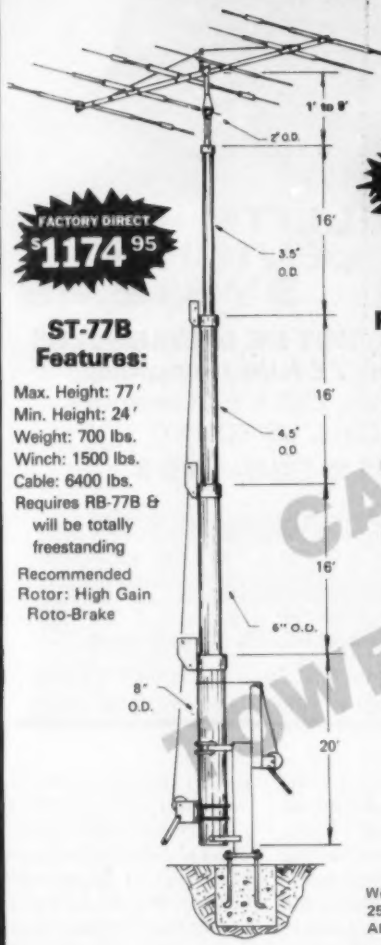


Fig. 9. Simulation of a metal tower.

↙See List of Advertisers on page 130

WILSON SYSTEMS TOWERS

— FACTORY DIRECT —



FACTORY DIRECT $1174.95

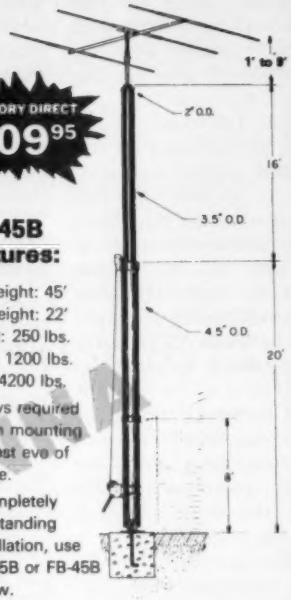
ST-77B Features:

Max. Height: 77'
Min. Height: 24'
Weight: 700 lbs.
Winch: 1500 lbs.
Cable: 6400 lbs.
Requires RB-77B & will be totally freestanding
Recommended Rotor: High Gain Roto-Brake

FACTORY DIRECT $674.95

MT-61B Features:

Max. Height: 61'
Min. Height: 23'
Weight: 450 lbs.
Winch: 1200 lbs.
Cable: 4200 lbs.
No Guys required when mounting against house.
For completely freestanding installation, use RB-61B or FB-61B below.



FACTORY DIRECT $409.95

TT-45B Features:

Max Height: 45'
Min. Height: 22'
Weight: 250 lbs.
Winch: 1200 lbs.
Cable: 4200 lbs.
No Guys required when mounting against eve of house.
For completely freestanding installation, use RB-45B or FB-45B below.

CALL FOR POWER RATES SPECIAL OFFER

WIND LOADING			
Tower	Height	Sq. Ft.	
ST-77B	69'	16	Square Footage Based on 50 MPH Wind
	77	10	
MT-61B	53	18	
	61	12	
TT-45B	37	18	
	45	12	

BASE CHART		
TOWER	WIDTH	DEPTH
TT-45B	12" x 12"	30"
FB-45B	30" x 30"	4½'
RB-45B	30" x 30"	4½'
MT-61B	18" x 18"	4'
FB-61B	3' x 3'	5½'
RB-61B	3' x 3'	5½'
ST-77B	See Below	Bases
RB-77B	3½' x 3½'	6'

Wilson Systems uses a high strength carbon steel tube manufactured especially for Wilson Systems. It is 25% stronger than conventional pipe. The tubing size used is 2" & 3½" -.095; 4½" & 6" -, 8" -.134. All tubing is cold dip galvanized. Top section is 2" O.D. for proper rotor and antenna mounting.

The TT-45B and MT-61B come complete with house bracket and hinged base plate for against-house mounting. For totally freestanding installation, use either of the tilt-over bases shown below.

The ST-77B cannot be mounted against the house and must be used with the rotating tilt-over base RB-77B shown below.

TILT-OVER BASES FOR TOWERS

FIXED BASE

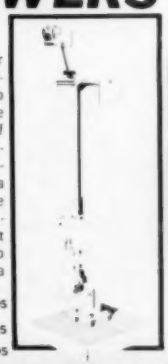
The FB Series was designed to provide an economical method of moving the tower away from the house. It will support the tower in a completely free-standing vertical position, while also having the capabilities of tilting the tower over to provide an easy access to the antenna. The rotor mounts at the top of the tower in the conventional manner, and will not rotate the complete tower.

FB-45B.. 112 lbs...$209.95
FB-61B.. 169 lbs...$299.95

ROTATING BASE

The RB Series was designed for the Amateur who wants the added convenience of being able to work on the rotor from the ground position. This series of bases will give that ease plus rotate the complete tower and antenna system by the use of a heavy duty thrust bearing at the base of the tower mounting position, while still being able to tilt the tower over when desiring to make changes on the antenna system.

RB-45B.. 144 lbs...$289.95
RB-61B.. 229 lbs...$379.95
RB-77B.. 300 lbs...$569.95



Tilting the tower over is a one-man task with the Wilson bases. (Shown above is the RB-61B. Rotor is not included.)

ORDER FACTORY DIRECT 1-800-634-6898

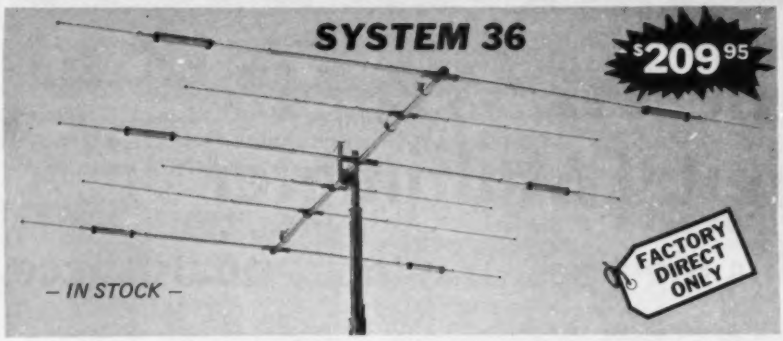
Prices Effective 9-1-81 thru 9-30-81
Specifications Subject to Change Without Notice

WSI WILSON SYSTEMS, INC.
4286 S. Polaris Ave., Las Vegas, Nevada 89103

WILSON SYSTEMS INC. MULTI-BAND ANTENNAS

SYSTEM 36

$209.95



A trap loaded antenna that performs like a monobander! That's the characteristic of this six element three band beam. Through the use of wide spacing and interlacing of elements, the following is possible: three active elements on 20, three active elements on 15 and four active elements on 10 meters. No need to run separate coax feed lines for each band, as the bandswitching is automatically made via the High-Q Wilson traps. Designed to handle the maximum legal power, the traps are capped at each end to provide a weather-proof seal against rain and dust. The special High-Q traps are the strongest available in the industry today.

SPECIFICATIONS

Band MHz	14-21-28	Boom (O.D. x Length)	2" x 24' 2½"	Wind Loading @ 80 mph	215 lbs.
Maximum power input	Legal Limit	No. of Elements	6	Maximum wind survival	100 mph
Gain (dBd)	Up to 9 dB	Longest Element	28' 2½"	Feed method	Coaxial Balun (supplied)
VSWR @ resonance	1.3:1	Turning Radius	18'6"		
Impedance	50 ohm	Maximum mast diameter	2"	Assembled weight (approx)	53 lbs.
F/B Ratio	20 dB or better	Surface area	8.6 sq. ft.	Shipping weight (approx)	62 lbs.

NEW!

ADD 40 OR 30 METERS TO YOUR TRI-BAND WITH THE NEW 33-6 MK

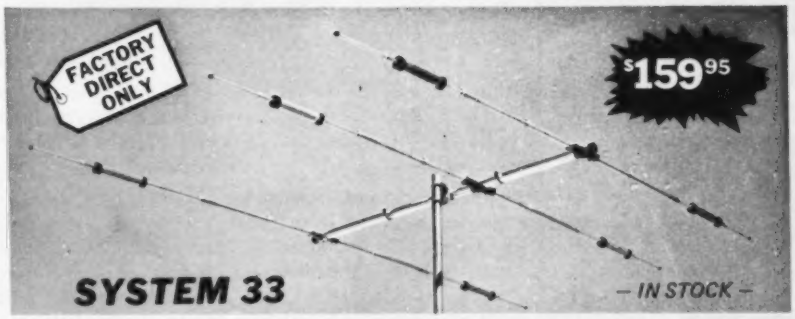
$59.95

– IN STOCK –

Now you can have the capabilities of 40-meter or 30 meter operation on the System 36 and System 33. Using the same type high quality traps, the new addition will offer 200 HKZ of bandwidth at less than 2:1 SWR. The new 33-6 MK will fit your present SY36 or SY33, and using the same single feed line.

SYSTEM 33

$159.95



Capable of handling the Legal Limit, the "SYSTEM 33" is the finest compact tri-bander available to the amateur. Designed and produced by one of the world's largest antenna manufacturers, the traditional quality of workmanship and materials excells with the "SYSTEM 33". New boom-to-element mount consists of two 1/8" thick formed aluminum plates that will provide more clamping and holding strength to prevent element misalignment. Superior clamping power is obtained with the use of a rugged 1/4" thick aluminum plate for boom to mast mounting. The use of large diameter High-Q traps in the "SYSTEM 33" makes it a high performing tri-bander and at a very economical price. A complete step-by-step illustrated instruction manual guides you to easy assembly and the lightweight antenna makes installation of the "SYSTEM 33" quick and simple.

SPECIFICATIONS

Band MHz	14-21-28	Boom (O.D. x length)	2" x 14'4"	Wind loading at 80 mph	114 lbs.
Maximum power input	Legal Limit	No. of elements	3	Assembled weight (approx)	37 lbs.
Gain (dbd)	Up to 8 dB	Longest element	27'4"	Shipping weight (approx)	42 lbs.
VSWR at resonance	1.3:1	Turning radius	15'9"	Direct 52 ohm feed – no balun required	
Impedance	50 ohms	Maximum mast diameter	2" O.D.	Maximum wind survival	100 mph
F/B Ratio	20 dB or better	Surface area	5.7 sq. ft.		

WILSON SYSTEMS, INC.

4286 S. Polaris Ave., Las Vegas, Nevada 89103

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WV-1A

4 BAND TRAP VERTICAL (10 - 40 METERS)

No bandswitching necessary with this vertical. An excellent low cost DX antenna with an electrical quarter wavelength on each band and low angle radiation. Advanced design provides low SWR and exceptionally flat response across the full width of each band.

Featured is the Wilson large diameter High-Q traps which will maintain resonant points with varying temperatures and humidity.

Easily assembled, the WV-1A is supplied with a hot dipped galvanized base mount bracket to attach to vent pipe or to a mast driven in the ground.

Note:
Radials are required for peak operation.
(See GR-1 below)

SPECIFICATIONS

- 19' total height
- Self supporting – no guys required
- Weight – 14 lbs.
- Input impedance: 50 Ω
- Powerhandling capability: Legal Limit
- Two High-Q traps with large diameter coils
- Low angle radiation
- Omnidirectional performance
- Taper swaged aluminum tubing
- Automatic bandswitching
- Mast bracket furnished
- SWR: 1.1:1 or less on all bands

GR-1

$14.95

The GR-1 is the complete ground radial kit for the WV-1A. It consists of: 150' of 7/14 stranded aluminum wire and heavy duty egg insulators, instructions. The GR-1 will increase the efficiency of the GR-1 by providing the correct counterpoise.

Robert B. Grove WA4PYQ
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Brasstown NC 28902

The VIZ WD-747 Digital Multimeter

—low cost plus high performance equals success

Although the name VIZ may seem to many readers a rather recent addition to the list of manufacturers of test equipment, it is not. For many years, this company maintained a low profile as a test equipment contractor for RCA. Now on their own, VIZ has announced a complete line of low-cost, technician-oriented test instruments.

The new WD-747 digital multimeter is an example. An innovative feature is the inclusion of a transistor hfe (Beta) tester. The DMM is housed in a rugged, bright orange Cycolac™ case. It is intended for one-hand operation, equipped with a line of squeeze buttons along the side, much like the popular Fluke instruments. The large (half-inch), 3½-digit LCD exhibits outstanding contrast, even in dim light. Settling-down time on all ranges is quite rapid.

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The circuit is built around the ubiquitous Intersil ICL7106 chip, and features auto polarity and auto decimal (not autoranging, however). Power is derived from an internal 9-volt battery (supplied) or from an external ac adapter (optional).

Dc current consumption is very low—only 15 mW—and 200 hours of continuous operation may be expected from a conventional zinc-carbon battery. Even longer life should be forthcoming from an alkaline replacement.

Sampling rate under test conditions is 2.5 times per second. If an overload condition appears at the terminals, all digits blank except an initial "1" and the decimal point.

Direct current voltages may be selected from the following ranges: 200 mV, 2 V, 20 V, 200 V, and 1000 V. Accuracy is ±0.8% plus one digit. Full overload protection is present on all ranges, and input resistance is 100 megohms.

Alternating current ranges of 200 V and 1000 V, each with a resolution of 0.1% and accuracy to 1.2% of reading + 10 digits, is claimed (40-500 Hz). Full overload protection is also provided on this scale, and input impedance is 5 megohms.

Five resistance ranges—200, 2k, 20k, 200k, and 2M—feature resolution to 0.05% and accuracy to ±1% of the reading plus 2 digits. Current across the resistive circuit under test is extremely small (a fraction of a milliampere on most ranges), with open-circuit voltage less than one volt (except 2.3 volts on 200-Ohm scale).

Direct current measurements are also divided into five ranges: 200 uA, 2 mA, 20 mA, 200 mA, and 10 A. Resolution is 0.1% and accuracy is ±1.2% of reading plus two digits. The current scale is fuse-protected from accidental voltage applications, and a spare fuse is included.

Either PNP or NPN transistors may be measured for current gain (hfe) static forward current transfer ratio. Direct readout is provided on the digital display.

Three distinct features of the VIZ WD-747 made the greatest impression to this reviewer: the crisp, contrasty LCD display, the rapid settling time on all ranges, and the wide selection of measurement ranges, all neatly grouped and color-coded for rapid, goof-proof selection.

At $89.95 suggested retail, the VIZ WD-747 is a serious contender in the field of low-cost, high-performance test instruments. For more information, contact *VIZ Manufacturing Co., 335 E. Price St., Philadelphia PA 19144.* Reader Service number 486. ■

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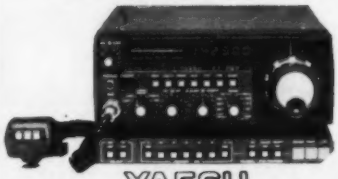

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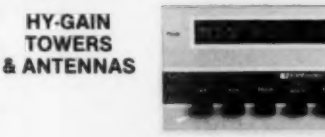

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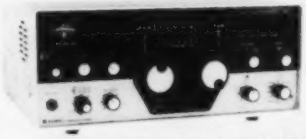

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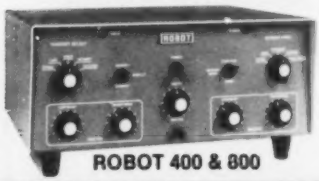

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The Winning

—days in the life of a contester

The contester is one of ham radio's most intriguing characters. For the better part of the year, he mostly lies dormant, occasioning a few club meetings and every once in a long while idly tuning the bands, looking for some hint of lost excitement.

The contest weekend hits. The resultant flurry of activity is of such a contrasting nature to his normal laconic presence that a casual observer would probably write the contester off as some sort of weirdo.

I've been what I thought was a contester for the past two years, only to learn—by way of a meeting with the Potomac Valley Radio Club, almost all the members of which are contest fanatics—that I was a mere piker. Shortly thereafter, my curiosity became aroused and I decided to investigate the experience of dedicated contesting.

"Experience" somehow falls short of expressing what actually happened. When you enter a contest for the purpose of winning, you have to assume a new being. You have to become . . . *The Contester*! Da-dum! The Contester, as such, gets *Psyched Up* for each and every point in each and every contest. Hypnotism is preferable, but a mite expensive. Zen is cheaper, but very deep and, as a result, more than a trifle difficult. So, the Contester usually musters the old standbys: power of concentration and physical conditioning.

Taking this in the literal sense, I decided that for the contest I chose, I was going to be Psyched Up *and* In Shape. What followed was a rigorous schedule of fitness-engineering designed to impress Muhammed Ali. For a month prior to the contest, it was up every morning at five, run several miles, eat a big breakfast, work out in the gym, rest, and lunch around noon.

In the afternoon, it was a daily session of meditation, mentally chanting the mantra, WIN . . . WIINN . . . WIIINNN! Later in the day, more working out and speech lessons (for the phone portion). Dinner was followed by CW work optimistically designed to improve my code speed to 40 wpm. By the end of the month I was a physical marvel. Well, almost.

The mental portion of my training, including the meditation, wasn't quite as easy. As I have mentioned, I would engage in my meditative session right after lunch. Aside from an occasional burp, there shouldn't have been much to distract my attention (especially with such an absorbing mantra). But, alas, I was to be foiled (for a while) in terms of one of the most crucial aspects of contesting: power of concentration.

Now, don't get me wrong. Contesters are very dedicated people, but most have one major flaw—they're dreamers. If they aren't dreaming about how nice that plaque would look just above the homebrew 4-1000, then they're dreaming about getting new and better equipment.

These comments are typical of what one might expect to hear at a contest-oriented club meeting: "Get an automatic CW machine, boy. You'll work 'em faster and log 'em easier. And while you're at it, get yourself a new speech processor. Ya need more punch. You'll cause more excitement, get more contacts, and *make more points!*"

Ah, yes, I remember it well. My mind was wandering terribly during those first few meditation sessions. I was constantly dreaming of mortgaging the house so I could get a surplus 350-foot tower topped by 5-element monobanders for 40 through 10 meters (only 4 elements for 75). I also considered coaxing the Contest Advisory Committee to allow for a new operator/station category: single operator, multi-transmitter. Just think! I could have two programmable CW machines going at once, with a tape recorder taking all the calls. On phone, I could run pretaped reports by using cassette recorders remotely controlled and coordinated by computer. Wow! Wow! Woowww!

See what I mean? Finally, through sheer willpower, I began to channel my mind toward constructive thoughts of winning. I was just beginning to get my head straightened out when the big day was upon me.

I spent all of contest eve tuning and retuning my station to a fine pitch. I still have scars on my legs from

shinnying up and down the trees in my yard in a last-ditch attempt to get the swr for my entire antenna farm down to a dB-encouraging 1:1. Now, before the state-of-the-art crowd protests that I was chasing the ghost of an old wives' tale, let me say that, with *this* Contester, old ideas die *very* hard. If nothing else, I was determined.

For a full hour before the contest was to begin, a well-rested, well-fed Contester-to-be sat in a lotus position, chanting and concentrating on making points. Finally, I leaped up, and screaming, *"I'm psyched!"*, ran into the shack. Immediately I began to throw switches with such ferocity that I almost ruined forever the front panels of my precision-tuned Vehicles-to-contest-Victory equipment. Notice the capitalization of the Vs. Man, I was ready!

Since this contest was a one-weekend, one-shot, DX affair, I had to cram hundreds (preferably thousands) of contacts into 48 hours of living. Operation on all HF bands on both CW and phone was allowed. I decided to tear into the CW portion first and was pleased that my code speed was up to par as I racked up contacts left and right.

After a few hours of dah-ditting my way into contest history, I decided to switch to phone and, in my most mellow, pious voice, began calling "CQ Contest."

Twelve hours and a gallon of coffee later, I knew I had to take a break. I could feel the weariness creeping in rapidly and was beginning to have problems with my CW fist. I had planned two two-hour breaks so as to unwind from each fourteen-hour operating period (or spasm, as the case may be). I immediately hit the sack, but due to all the excitement and coffee, was unable to get to sleep. It seemed like two minutes later when the alarm went off and I rolled out knowing I should have had more sleep and less coffee. Of course, it wasn't long before I rationalized that sleeping wasn't important, but points *points*, POINTS were! Back to the coffee urn. The XYL was graciously cooking some wing-dinger meals that could be consumed in 5 minutes or less without indigestion.

As I began my second period of operation, I noticed that the band conditions were kind of flat and, consequently, my QSO rate was pretty slow, at best. Later, as evening brought better propagation and more operation, things began to pick up. But by now I was beginning to feel the effects of my lack of sleep. My QSO rate seemed to be rocketing along at a snail's pace. Time was dragging so badly that I began to wonder if I was in a radio contest or a tractor-pulling event. Ten hours into my second period of operation, my dupe sheets began to send bad vibrations to my brain. With every call I heard I thought to myself, "I *know* I've worked him before. That call sounds so familiar." Then I'd furiously scan the dupe sheet with a disbelieving attitude. If the guy's call wasn't on the sheet, I'd think to myself, "I must've left it off when I worked him before." *POOF!* went my mental state.

At last my second "spasm" was over. Only one more to go. I cursed myself all the way to the bedroom, berating that insane man who not more than a month ago decided that he wanted to be "The Contester." Where was he now?! Why, the little beggar crawled off into a hole somewhere and was sleeping regular hours, eating regular meals, and watching the boob tube! Left in his place was an empty 4-1000A of a man. A glass bottle that you could see clear through. Man, did I need sleep!

Two hours later, I groggily switched off the alarm and, feeling as though I'd managed to collect only one or two or my marbles, flopped out of the sack and into the dining room. The XYL timidly served my meal (was it breakfast or dinner?), not too sure of what my mood would be. I was courteous, but quiet. After eating, it was back to the shack for the last grueling episode in this very strange "experience."

My senses began to function just long enough for me to realize that it was around 8 am, Sunday. Most people on the east coast would be on their way to church, so maybe my competition won't be too bad. Fat chance! I'd forgotten all the other people in this contest were maniacs just like me, and church was out of the question.

My memory of what happened for the next 12-13 hours is very blurry. About the only thing that comes back to me is the feeling that my fist and mouth were molded from solid lead—very hard, very heavy, and quite immovable. Looking back on my logs, what I can read of them, I see that I managed to run a respectable QSO rate, considering my condition. I didn't even work too many people that I'd worked before.

However, my XYL's memory and description of the events during and after the third period of operation were a lot sharper. Apparently, I occasionally stumbled in and out of the shack with glazed eyes, mumbling something she was afraid to listen to. She claims my voice sounded like the buzzsaw at the local lumber yard, and there were times when she would look in and see me sitting at the desk going through the motions of speaking and sending CW at the same time, but actually doing neither. The keyer wasn't in my hand, I wasn't near the mike, and I wasn't saying anything! WOW!

At last the contest was over and, according to her, I got up, turned on my heel with military drill-team precision and proceeded to walk straight into the wall. She then quietly led me down the hall and tucked me into bed. All the while I was quietly saying, "dah-dit-dah-dit dah-dah-dit-dah," over and over again.

I can now say for the first time in my life, that I fully appreciate what it means to "crash." The youth of our nation are to be praised for coining such a descriptive term. I crashed so hard that it took me 18 hours to wake up and another 24 hours of very peaceful surroundings to come fully to grips with myself.

It's been months since the contest and I haven't dreamed of the "single-operator, multi-transmitter" category for a long time. In fact, I haven't really been on the air since the contest. Even so, I've occasionally gone into the recreation room, looked at the weight-lifting equipment that I had worked on so hard, remembered those hours of meditation, and smiled. Then, of course, I would turn and walk away. Until today.

When the mail arrived, the contest results were in the ham magazine that sponsored the event and, what's this? I placed third in my section? I beat out a whole raft of more experienced operators? WOW! If only I hadn't snapped out in the waning hours of the contest! Let's see, if I add another ten-foot section to the tower, how many dB of gain will that yield? When's the next contest? Only six weeks away? Oh man, here we go again! WIN... WIINN... WIIINNN!■

John Ackermann AC9V/1
73 Magazine Staff

The GU-1820 Ac Generator

—100 pounds of portable power from Heath

A major problem in any emergency planning or Field Day preparation always seems to be finding a generator. Most commercially-available gas generators are either too large or too expensive to be practical for most hams to own. Finding a generator to borrow or rent isn't always easy, either. Now Heathkit™ has helped to solve this problem with the introduction of the Heath-Watt portable generator.

The Heath-Watt uses a five-horsepower four-cycle engine to drive a generator capable of providing 2200 Watts of continuous ac power. This is more than ample to power, for example, a complete two-transmitter Field-Day operation if linears aren't used.

The only assembly involves mounting the engine to the main frame and assembling and mounting the generator itself to that frame. When the packages containing the kit arrived at the *73* ham shack, the question arose as to who should put it together. I am fairly handy with a soldering iron, but it is widely known that I am dangerous with a socket wrench in hand. It was therefore decided that I should be the kit builder—the others felt that if I could do it, *anyone* could!

Well, I did it. The total assembly time was about six hours, although that time included several delays for rag chews, refreshments, and snide comments from the more mechanically-adept members of the staff. This was not, however, the most enjoyable time I have had putting a Heathkit together.

I've always had a suspicion that the Heath technical writers are at their best when describing electronic assembly and not so hot on mechanical steps. This kit seems to prove that hunch correct. Don't get me wrong—if you follow the manual, you will end up with a working generator, but I feel the instructions are not as clear and straightforward as I've come to expect from Heath. Part of the problem is that the terminology of generators is not as familiar to most of us as is the language of electronic construction. I found that frequent reference to the pictorials both for parts identification and for an understanding of what each step entailed was necessary.

Construction of the Heath-Watt itself presented few problems. The only real difficulty encountered was in forcing a bearing into the end casing of the generator. Heath provides a wooden dowel to use with a hammer to drive in the bearing, and the instructions note that "it may be necessary to strike the wood bearing driver with considerable force to seat the bearing properly." The instructions are correct on that point. It took such "considerable force" to drive the bearing in that the wood dowel split in half long before it was seated properly.

In fact, we never could get the bearing in flush with the end casing and, as a result, a plastic bracket that mounts over the bearing ended up with a slight bow. This problem caused us some concern, but did not appear to affect the perfor-

Heath's GU-1820 ac generator.

Continued on page 51

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Radio Rehab

—how ham radio helps young offenders

Robert Stuart Zamalin WA6VIP
7012 Newlin Avenue
Whittier CA 90602

Can ham radio be used as a means of rehabilitating young offenders? Attorney Steve Stevens KD6BS believes that it can. He belongs to the Volunteers in Parole, a variation of the Big Brother organization, which pairs young parolees from the California Youth Authority and volunteer attorneys. The goal of the VIP is to help parolees to adjust to the outside world and become productive citizens after being released from the custody of the California Youth Authority.

Attorney Steve Stevens KD6BS in his shack.

Steve, who has been involved in radio since 1953, believes that ham radio is an excellent means of diverting the young parolee's interest from criminal activities into something constructive. He believes that the various activities in ham radio can help the parolee to associate with individuals outside his own peer group. Because of the fact that the hobby cuts across income, occupational, and ethnic boundaries, it is an excellent way of mainstreaming the parolee into the world outside a correctional institution.

The Volunteers in Parole grew out of the suggestion of Supreme Court Chief

Justice Warren E. Burger that lawyers get involved in the correctional system and help it become something other than a revolving-door process. The first VIP programs were set up in Los Angeles and Santa Clara in 1972, and since then, San Diego, Sacramento, and San Francisco have started VIP programs.

The parolees are matched up with volunteer attorneys who have the same basic interests in similar hobbies and sports. The attorneys are asked to spend at least five hours per month with their parolees over a period of six months. In reality, they often spend more time than that with their charges, absorbing a lot of the expenses out of their own pockets.

Motivating the parolee is not difficult if you try to set up a positive role model, claims Steve. "If you get a relationship with the kid and if the kid is trying to emulate you, it is not difficult to motivate him. With the right type of relationship, he wants to try what he sees you doing."

Currently, Steve is working with a parolee named Kelvin, helping him to get his Novice license. This is the first parolee he has gotten involved in ham radio. He brings Kelvin to his house so that he can see firsthand what ham radio is all about. Steve is also considering setting up a Novice class at two of the juvenile detention facilities in California's Santa Clara County, locally known as the Boys' Ranch and the Girls' Ranch.

As much as he feels ham radio is good for diverting young people from criminal activity, he has serious reservations about using ham radio in rehabilitating adult offenders. "Most of the adult offenders would probably see it as a way of communicating with each other as to whether or not the cops were coming—or something like that," he cautioned. "I don't want to run that risk."

Elaborating further, he indicated that "statistics show that normally 25 years of age becomes a turning point in life. An individual either gives up a life of crime altogether or he becomes a criminal for the rest of his life. What I am concerned with primarily, therefore, is catching those youngsters before they get to the big time."

Steve is well qualified for this sort of activity. He received his communications training in the Air Force in 1953. He has been teaching a Novice class for the past year, and he runs a 10-10 net. He is very active on two meters. His many pieces of equipment include a KLM Multi-2000 which is his all-mode base station, a Tempo VHF/One Plus which serves as his mobile rig, a Santec handheld that he uses when traveling, and a old Polycom that he uses when monitoring his favorite DX repeater. His interests also branch out to microcomputers, and he plans to purchase one to interface with his gear and so keep home accounts.

It is very important for young people who have been involved in criminal activity, especially those who have served time, to keep busy with constructive activities so they don't have time to revert back to their old behavior patterns and make the "big time." Fortunately, there are people like Steve who care enough to help young parolees coming out of the system and divert them from criminal pursuits to other, more worthwhile, activities like ham radio. ■

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Do you enjoy 220-MHz operation but find you don't have the power to access those few-and-far-between 220-MHz repeaters? I did, and since I couldn't afford a new amplifier, I decided to experiment.

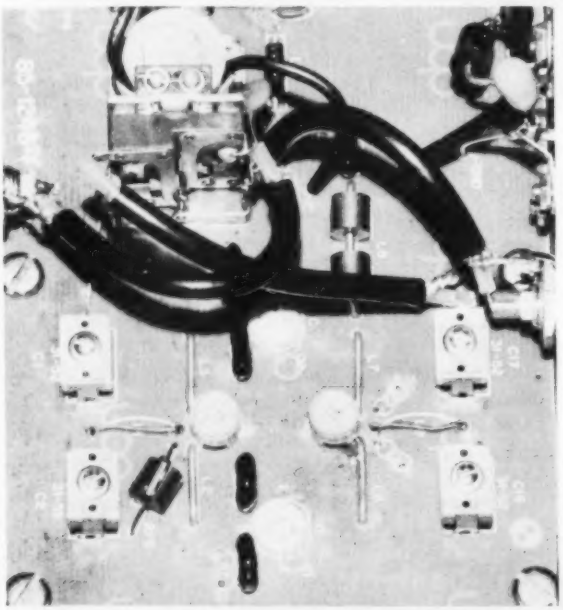
This is an easy modification to an inexpensive piece of equipment and will give you what you need in those fringe areas. More time will be spent taking off and putting on the case than on the changes themselves!

The HA-202 two-meter amplifier can be turned up at swapfests for about $40. The more recent HA-202A uses a different output circuit and requires a more extensive modification which is not covered by this article. The HA-202 is used because its 2N5591s are usable to 250 MHz.

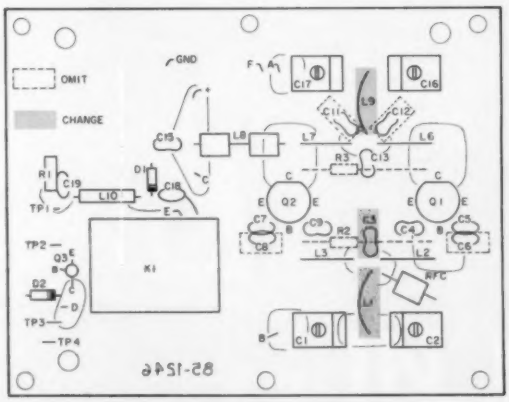
Before this modification can begin, the PC board must be exposed. To do this, perform the following steps in order!

1) Remove the C-shaped cover.
2) Remove the two nuts securing the power transistors to the heat sink.
3) Remove the six bolts securing the heat sink, sides, and the PC board.

To begin the modification, refer to Fig. 1. Remove L1, C3, C6, and C8 from the input circuit. On the output circuit, remove L9, C11, and C12. Save C12 for later use.



The completed modifications for 220 MHz.



(VIEWED FROM COMPONENT SIDE)

Fig. 1. Component location.

Now replace L1 and L9 with a 3/4" piece of straight wire (similar to L2 and L3). Next, use a 22-pF capacitor you just removed from C11 or C12 to replace C3.

Since the case is already off, now's your chance to install a disaster-preventing reverse-polarity protection diode from B+ to ground just inside the case (see Fig. 2). Just about any silicon diode rated three Amps or larger will work. Be sure that the cathode band is connected to B+.

If you're like me and have just got to get that extra Watt out of an amplifier, then use a 5-to-30-pF ceramic trimmer is place of C3 and C13.

Now reinstall the PC board, but do not replace the C-shaped cover. Tune your HA-202 for maximum output starting with the output section. Typically, the HA-202 produced 40 Watts out with 10 Watts of drive on two meters. On 220 MHz there is a slight reduction in output power, but you can still expect 30+ Watts out.

My thanks to WB5WRR for confirming that this modification is an easy, inexpensive way to generate some power on 220 MHz. Also, my thanks to KA5GWL for knowing how to put words together. ■

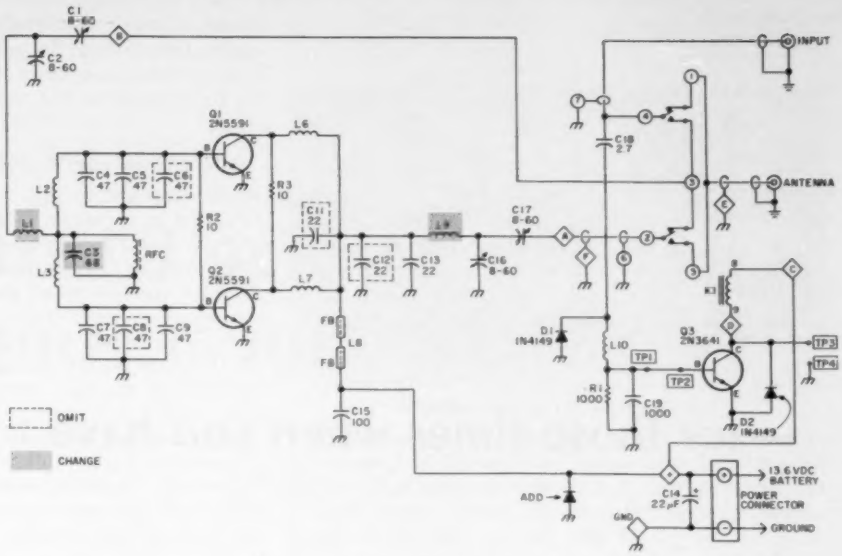


Fig. 2. HA-202 amplifier schematic.

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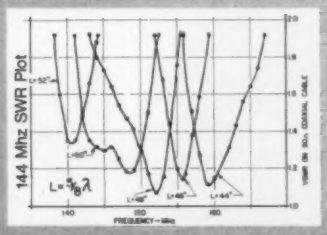

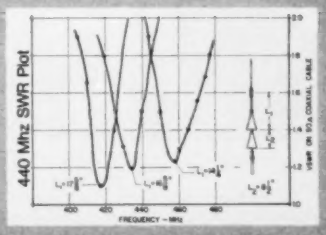

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Paul Grupp KA1LR
73 Magazine Staff

The Mirage B1016 Two-Meter Linear Amplifier

—for those times when you have to be heard

When I moved to New Hampshire from the midwest a year ago, the repeaters out here really took me by surprise. The coverage is phenomenal by any standard I am accustomed to, but so are the dead spots when a mountain gets between you and the repeater! Clearly, 10 Watts of power is not enough for reliable communications. The final straw came when I became interested in 2m SSB—I had to have an amplifier, and preferably one that included a receive preamplifier. After pricing the market, I decided that I might as well go for something really "loud," and one of the most powerful amplifiers this side of a homebrew 4CX-250 is the Mirage B1016. For the uninitiated, this particular model is capable of putting out 160 Watts with only 10 Watts drive and is an extremely compact package measuring 12" × 3" × 5.5". It appears to be very conservatively designed and is covered by a five-year warranty on everything but the rf power transistors (which are covered by a one-year warranty).

When the B1016 arrived, I immediately installed it in my car. An amplifier that produces this much power is not to be taken lightly, so I took the precaution of installing a short, heavy run of #10 wire directly to the battery. RG-58/U is not really designed to handle 160 Watts at two meters, so I fitted my Larsen roof-mount antenna with a good grade of RG-8/X. All front-panel switches may be remoted using an optional control box, permitting the amplifier to be installed in an out-of-the-way location, with a remote-control box conveniently at hand.

The Mirage B1016 two-meter linear amplifier.

It should have come as no surprise, but it was nevertheless exciting to discover that 160 Watts allows me to talk through repeaters I couldn't even kerchunk before. I had grown accustomed to losing contact with my favorite repeater along certain stretches of highway—from these same spots I was now into the machine with a reasonable level of quieting! Importantly, the B1016 is fitted with a very good 10-dB gain receive preamplifier. Switching it in kicks up the S-meter several units and quiets the received signal noticeably. The preamplifier does its best work on SSB. It never made a totally indecipherable FM signal readable, but it frequently allowed me to communicate with SSB stations that I couldn't otherwise copy. I have yet to encounter a multi-mode two-meter transceiver that won't benefit from the Mirage preamplifier.

How Do I Key This Thing?

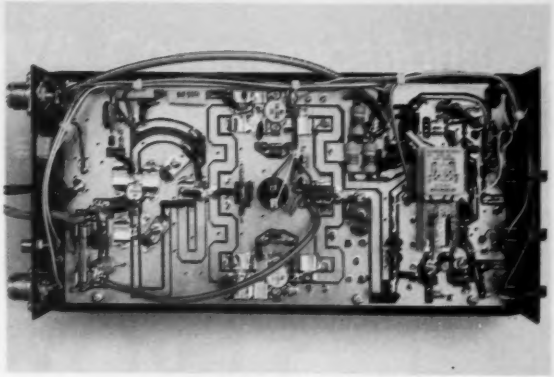
You'll notice from the photograph that there is an FM/SSB switch on the front panel. Since the amplifier is biased for linear operation in both the SSB and FM modes, this has absolutely nothing to do with the linearity of the amplifier. It merely selects no delay rf-sense switching in the FM mode and adds some delay in the SSB mode. Rf switching is convenient but is really an unsatisfactory compromise. If you set the hang time long enough so that the amp doesn't cut in and out between words, it takes an uncomfortably long time to switch to receive after you let up on the PTT. Moreover, the Mirage has separate relays for the preamp and amplifier sections so that everyone has to listen to two relays chattering away. Do yourself a favor and wire up for direct keying when you install the amplifier. In only takes a moment, and think of the fun you'll have scaring your know-it-all friends every

time you operate SSB with the delay switch in the FM position!

The B1016 can draw over 20 Amps of power (it's fused for 35) at 13.6 volts dc, so care should be taken in choosing a power supply. For a VHF contest weekend, I used a hefty Astron RS-35M supply, rated at 20 Amps continuous duty, and it barely got warm. The heat sink on the amplifier itself gets pretty hot after three or four hours of screaming "CQ contest" into the microphone, but at no time did I cause the temperature-sensing protective circuitry to cycle. At 170° F., a thermostat shuts the amplifier off, and doesn't return it to normal operation until the temperature drops to 140° F.

Who Needs 160 Watts?

Even in the flatlands of the midwest, a powerful amplifier is useful for FM operation. It is comforting to know you have an extra margin of power when mobiling at the fringe of a repeater's coverage area, and it's a pleasure to carry on simplex conversations over distances that would normally require a repeater. Nevertheless, two-meter SSB is where the B1016 really shines. You haven't lived until you've worked some two-meter SSB DX, and the B1016 will allow you to do it on a regular basis! For more information, contact *Mirage Communications Equipment, Inc., PO Box 1393, Gilroy CA 95020.* Reader Service number 488.■



Bottom view of the Mirage B1016.

GU-1820 *from page 42*

mance of the generator. A suggestion to Heath: Either manufacture the metal parts with slightly greater tolerances or provide the bearing already pressed into place.

After assembly and fueling, the gang stood back and held its collective breath while the starter cord was pulled for the first time. The engine started beautifully, and the light bulb connected to the output lit just as Heath said it would. After letting the engine run long enough to make reasonably sure that the mechanical parts were working correctly, we hooked the output (through a step-down transformer) to an oscilloscope to have a look at the waveform. It definitely wasn't as clean as the mains, but the frequency was very close to 60 Hz and the line voltage was right on the money at 117.

After ensuring that it was safe to connect equipment to the output, we hooked up a transceiver to see how the Heath-Watt would do at providing useful power. It did very well. The TS-530S ran just as it did when connected to New Hampshire Public Service. The nicest news of all was that the receiver suffered no interference at all from the generator—it was just as quiet as when running from the mains.

The generator's first real test came a few weeks later at the *73* gang's Field-Day site, where it was the sole source of power for our class 2A station. The Heath-Watt ran flawlessly for well over 24 hours and, although it was possible to tell by the sound of the engine when a rig was keyed, it handled the load of two transceivers, assorted keyers, lights, and rotors with no trouble whatsoever.

As generators go, the Heath-Watt was rather quiet. We set it up about one hundred feet from the operating tent behind a large boulder and had no noise problems at all. The hundred foot hike through the brush for refueling did make that part of Field Day more exciting than usual. Heath says that the generator's half-gallon gas tank will provide about 1¾ hours of operation at 50% load. That estimate seems conservative, and there were times when it seemed as though the gas would last forever (those were usually the times an operator was waiting anxiously in front of a battery-powered rig to take over when the generator died). It would be nice if a still-larger gas tank were available—a generator should not really have to be fed every couple of hours during an emergency. A tank twice the size would produce half the aggravation.

The Heath-Watt seems to be the ideal answer for an individual or group wanting to have emergency power capability at a reasonable cost. This generator is relatively inexpensive for the amount of power it produces and is small and light enough so that storage and transportation are not a real problem; one man can easily move it if necessary.

For more information, contact *Heath Company, Benton Harbor MI 49022.* Reader Service number 487.■

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The Heathkit SB/HW-100 series of transceivers is one of the most popular lines in the ham market. Unfortunately, the SB-100 line has been discontinued, but the HW-101, with the identical circuit minus some bells and whistles, lives on. Having owned an SB-101 for a dozen years, I found that the transmit audio was just barely adequate, and if a mike with low output was used, it was downright weak. External preamps are handy but involve extra batteries or power supplies, and are generally a nuisance.

After examining the SB-101 schematic, I noticed that I had an auxiliary crystal oscillator which I never used. The circuit uses half of V5, a 6EA8. With a few modifications—wiring and not cosmetic—the triode section of the 6EA8 can be used as an audio preamplifier. When I looked at the schematic of an HW-101, I discovered that it did not have the auxiliary crystal circuit. In fact, the triode half of V5B is not even used! It's sitting there waiting for you to add three resistors and capacitors to make it an audio preamp.

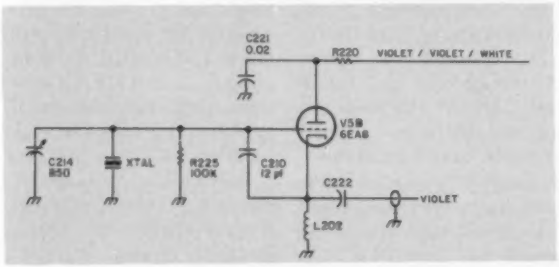

Fig. 1. Original SB-101/102 circuit.

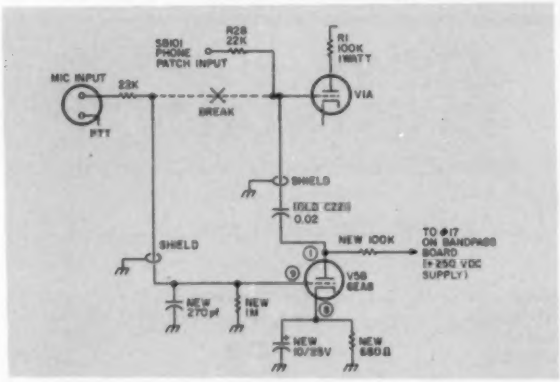

Fig. 2. Preamp circuit for HW/SB-101 using V5B.

Preparing the SB-101

If you have an HW-101, skip this step. If you have an SB-100 series rig, you must first remove the oscillator circuit parts. Carefully unsolder resistors R225 and R220 along with L202 and capacitors C214, C222, and C221. (See Fig. 1.) Save C221 as it will be used for the coupling capacitor in the preamp. The violet cable and violet/violet/white wire should be disconnected and taped carefully out of the way.

Wiring the HW/SB-101

Fig. 2 shows the new circuit. There are three resistors to install and three capacitors (one is C221 from the SB-101). Some of these parts can be installed in the available circuit board holes. The 100k plate resistor is connected to a wire which is soldered to the number 17 hole (+250 V dc) on the bandpass board.

The lead from the mike connector to V1A is broken and routed to the preamp, as per the diagram. Use shielded cable (and I installed a ferrite bead on V5B's grid lead to prevent rf pickup). The SB-101 has a phone-patch input paralleled with the mike input. Break the lead and install the preamp before the phone patch, unless your phone patch has a low-level output.

While you are inside the rig, I recommend changing R1, the plate resistor on V1A, to a 1-Watt resistor. The half-Watt original does not dissipate enough heat and may change value. I found that mine rose to 300k and cut the audio even further.

The modification is simple and can easily be removed if necessary. I have had this circuit in my transceiver (SB-101) for a number of years and get consistently good audio reports. Be careful that you do not overdrive the rig, as there will be substantial gain. I run the mike level at about 9 o'clock, one-fourth of the way up. ■

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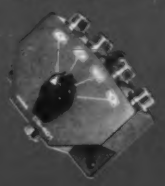

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Tim Daniel N8RK
73 Magazine Staff

Gunnplexer Cookbook

Why aren't you operating on 10 GHz? Surely, you have heard of the Gunnplexer, a Microwave Associates' product aimed at making the average ham a master of microwave magic. Despite its availability, reasonable price, and simplicity, the Gunnplexer is about as popular as an AM signal on 20 meters. Now there is new hope for discovering life on 10 gigs. The *Gunnplexer Cookbook* blows the top off the subject, eliminating the problem of finding information and applications.

Authored by Bob Richardson W4UCH, the book goes beyond the whys of Gunn diode theory and delves into the hows of putting this technology to use. The sixteen chapters start with the basics and end with the design and construction of a computer or TV video link. Along the way, you'll learn about range, bandwidth, i-f amplifiers, antennas, and anything else that has to do with the practical aspects of life on 10 GHz.

The joy of W4UCH's book is that you can duplicate the projects. There are detailed plans for building frequency and power meters, power supplies, waterproof enclosures, parabolic reflectors, and temperature controls. These building blocks can be combined into a Level 1 or a Level 2 communications system. The author worked alone, at home, so he was forced to devise inexpensive and readily-available substitutes for exotic microwave gear. The text is supplemented by photos, diagrams, printed circuit layouts, and even information about suppliers.

If you have mastered the easy applications and are ready for experimentation, check out the *Cookbook's* discussion about making the Gunnplexer sing on single sideband. The proposed phase-locked-loop "crystalmatic" scheme has attracted some skeptical comments from other microwave aficionados. But the critics are sorely lacking when it comes to suggesting alternatives. Another one of Richardson's ideas calls for using a conventional AM television to receive FM video signals. Common sense dictates that this cheap and dirty approach won't work, but the proof is in the viewing.

Still not convinced that 10 GHz is the place to be? Then maybe you should dust off that old AM rig. All jokes aside, The *Gunnplexer Cookbook* is the definitive source for information and inspiration for aspiring microwavers. It costs $9.95 and is available from The Ham Radio Publishing Group, Greenville NH 03048. ■

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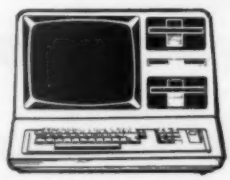

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The Green Gallon

— an HW-101 look-alike (except for those four 811As)

This article describes a project which evolved into a 1-kW linear amplifier. The unit has been several months in the making. The effort put forth in building this project is dedicated to the amateur who enjoys the satisfaction of creating, building, and operating his own professional equipment.

The parts and subassemblies required to fabricate the amplifier were obtained from local hamfests or were reluctantly surrendered from junk boxes by fellow amateurs. It is intended that the theme of this article shall emphasize layout rather than circuit design.

The housing of four 811As, with filament, relay, and bias supplies into an HW-101 cabinet was preceded by many hours of planning. The power supply is housed in a separate box and connects to the linear via the control cable.

The Green Gallon linear amplifier is designed to be packaged into a Heathkit® HW-101 cabinet. The new assembly thereby creates a tabletop twin for my HW-101 transceiver.

Prior to building this amplifier, it was necessary to send a shopping list in the form of an order blank to Benton Harbor, Michigan. The Heath Company is very accommodating about selling piece parts. The top and bottom cabinet sections for the HW-101, three large, and two small skirted knobs were major items purchased. Minor items included four rubber feet and two plastic risers; all items added up to a cost of $35.00. Other front-panel parts such as the 1-1/4"-square panel meter, rotary bandswitch, and power on/off switch were purchased at local hamfests.

After surveying the available tubes, the 811A was chosen for this design. The reasons for the selection were twofold: (1) The tubes are relatively inexpensive and readily available, and (2) They can be operated at a relatively low plate voltage of 1500 volts, thereby making the power supply components less expensive. The disadvantage of using the tube is that four are required for full legal input power.

With this major decision out of the way, consideration was given to the tank-circuit components

Photo A. Front view of amplifier showing all controls and taped top louvers.

Photo B. Back view of amplifier showing cooling fan and dual coaxial relays.

because their physical size would dictate the entire layout. The tuning capacitor, a Cardwell, was purchased for $8.00, along with the large four-contact bandswitch for $1.00. The capacitor is a large unit with counterbalance weight, rated at 220 pF at 3-kV spacing. The four-position switch was part of a US Navy tuning unit and may be undesirable to some, but it did not cause any great problem in my shack because 40 through 10 are my prime bands of operation. For different bands, the tank could be modified easily to suit the individual's needs. The output loading capacitor is a conventional broadcast type with the three gangs wired in parallel, giving 1500 pF.

I constructed the main chassis using a sheet of 3/32" aluminum mounted on three angled pieces having dimensions of 1" on a side. Considerable thought was given to the layout and shielding of the rf input and output compartments. As shown in the photos, the four tubes were staggered horizontally in order to conserve space.

Orientation of the 811As is very critical due to their internal grid-support structure. The tubes must be placed with the grid-support posts aligned atop each other to prevent grid sagging and possible shorting when the tube is hot. The ceramic tube sockets are mounted to a piece of formed sheet aluminum.

The rf input circuit is completely enclosed, using a modified aluminum chassis and perforated aluminum sheet. A 10" × 5" × 3" standard chassis was cut lengthwise to make a 10" × 5" × 1-1/2" open shell. Next, the bottom side was removed so that a U-shaped shell remained which could be pop-riveted using L-brackets to the tube support. Although this may sound complicated, it is hoped that the photos reveal its simplicity.

The rear of the amplifier consists of a modified chassis box used as an rf input compartment, in which the 811A tube sockets were mounted. This chassis is covered with a perforated aluminum shield to complete the input enclosure. Input switching and tuned cathode circuits were eliminated because of space limitations. The decision was made knowing full well the risk of increased intermodulation distortion and high swr between exciter and amplifier. Prior to mounting the rear shield, the two Dow-Key coaxial relays were bolted to it with spacers.

The 6.3-V ac, 20-Ampere filament transformer was mounted toward the rear of the amplifier, providing its large secondary wires a short connection directly to the filament feedthroughs on the inner side of the rf shield. The feedthroughs were constructed using #6 machine screws and nuts, solder lugs, and insulating washers.

The bias and relay power transformers with their associated components were mounted directly in front of the filament transformer. The bias-supply uses a 6.3 V ac, 1-Ampere standard filament transformer in a reversed hookup, and feeds a simple half-wave filtered section. Components for the two supplies are mounted to lugged terminal strips. For simplicity, I pop-riveted the strips to the inner final rf cage.

The front panel was made from a piece of 1/8" aluminum obtained through the courtesy of a fellow ham with a free junk box at the local fest. The piece was cut to 14-1/2" × 6-1/4", and its corners were filed round to match the HW-101's front panel. Now, the panel must match the color of the 101, so I searched at the local automobile parts outlet for one of those spray cans of touch-up paint. An acceptable green was found at $1.00 a can (GM part #DS-GM 283). One can will supply several coats with some left over. Before spraying, remove all grease

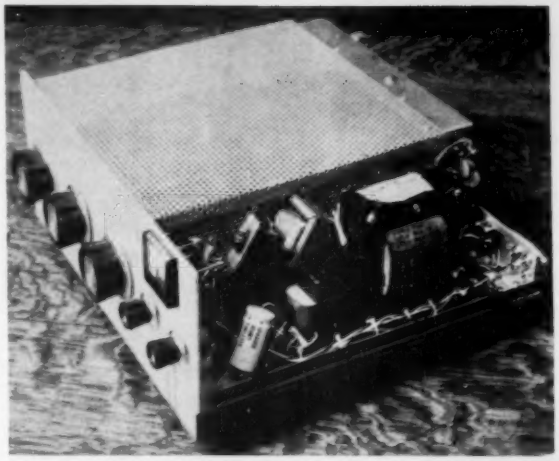

Photo C. Side view with top cover removed showing filament bias, and relay supplies.

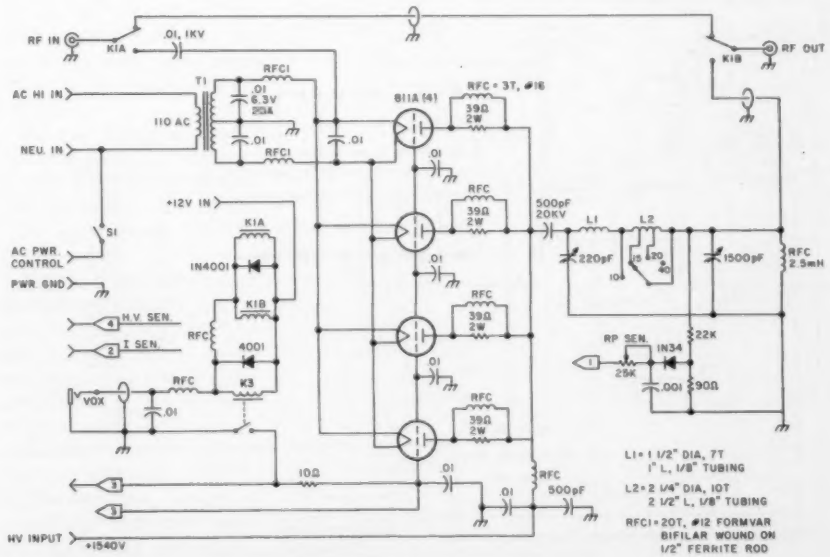

Fig. 1. 1-kW linear amplifier.

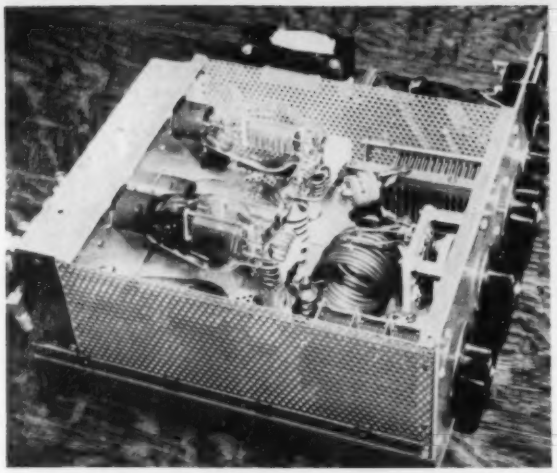

Photo D. Side/top view with top of rf cage removed showing 811As and final tank circuit.

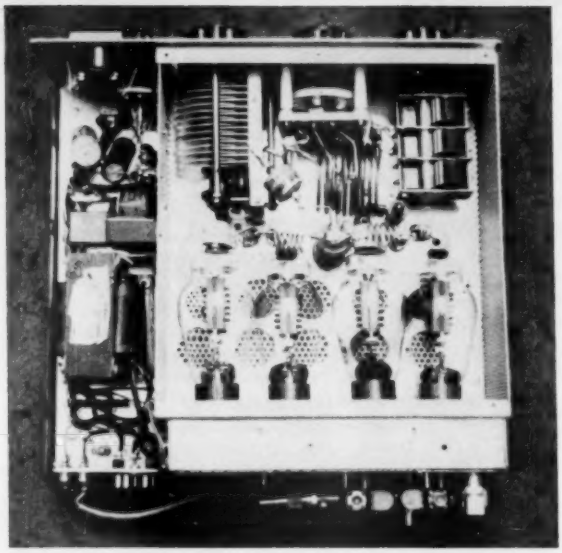

Photo E. Top view with rf cage removed, showing placement of rf tank components plus power supplies.

with a suitable solvent and then apply two coats of a suitable primer.

Like the HW-101 but unlike the SB-220 or SB-200, the power supply is housed in a separate box with a power control cable plus HV cable running between it and the amplifier. The heart of the power supply is the Berkshire 6181 transformer—all 30 lbs of it. This transformer has a dual primary to accommodate 120- or 220-V ac input and a single secondary rated at 1100 V and 550 mA. The unit was purchased directly from the manufacturer at a cost of $58.00 including postage and handling.

The rectification is handled by twelve 3-Ampere, at 1-kV diodes with 1/2-Watt carbon resistors in parallel with spike-preventing capacitors. A series of four capacitors, with bleeder/equalizing resistors, filters and increases the 1100 volts to 1540 volts. This level will drop about 100 volts when the amplifier is pulling its full plate current of 600 mA. Incidentally, I bench-tested the power transformer at 1100 V with a 1-Ampere load with no apparent heating. The power supply is energized via a control relay in the power supply and a power switch located on the amplifier's front panel.

Surge protection for the bridge diodes is assured by relay K2, with its contacts and a series resistor in the transformer's primary circuit. Time delay is about six seconds with 250 Ohms and 110 V ac on the primary. Sense resistors for the plate current and voltage are located in the bleeder-resistor string.

All metering is handled by a 100-uA meter. The meter function switch is a five-position ceramic type with the center position grounded. This gives a convenient meter-disable position between two active positions on each side. If a different meter movement is used, the calibration resistors will have to be altered accordingly. The meter face was re-scaled with 0-2 and 0-1 markings. The grid current and plate voltage use the 0-2 scale which provide 200-mA and 2000-volts full scale readings. The plate current and relative power output use the 0-1 scale, with 1000 mA and 1000 Watts, respectively.

When the power switch is activated, the grid bias supply immediately applies −125 V ac to all grids,

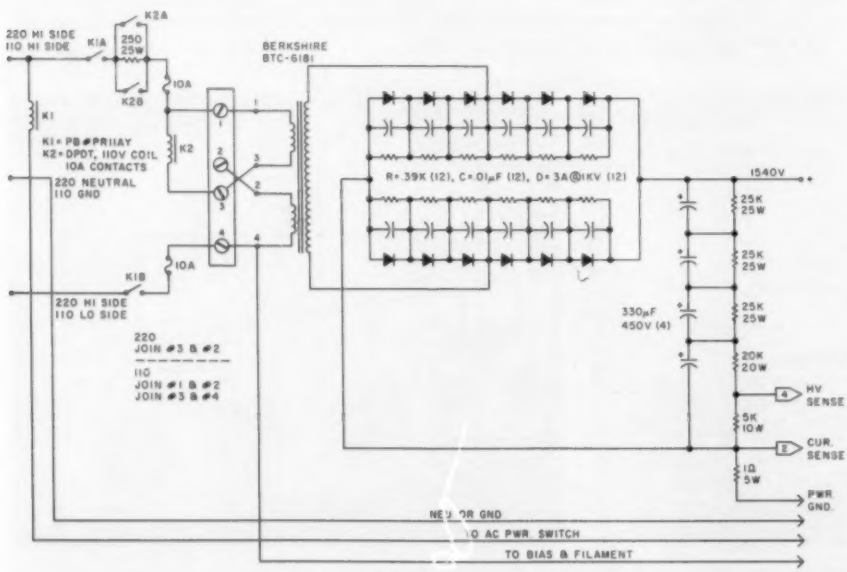

Fig. 2. Power supply.

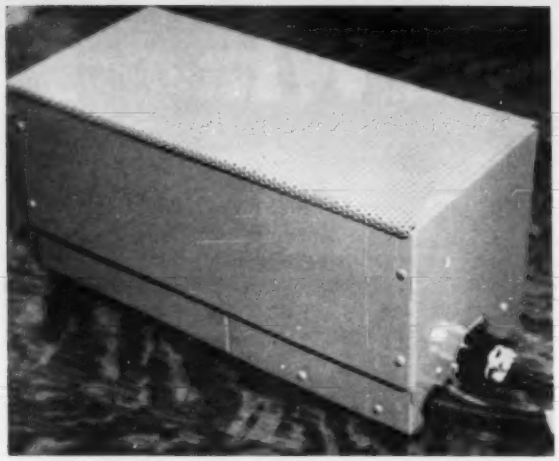

Photo F. High-voltage power supply with cables.

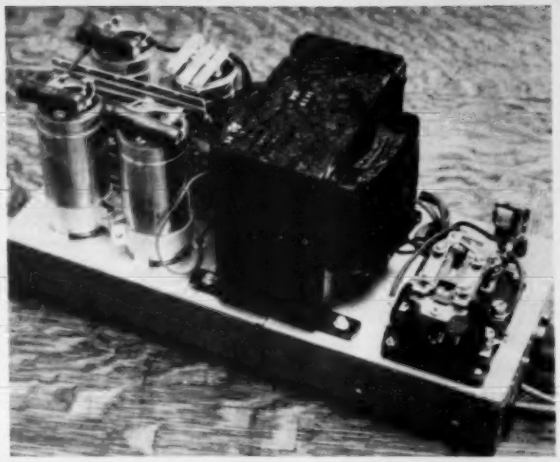

Photo G. Layout of high-voltage power supply. Rectifiers are on PC board mounted between the filter capacitors.

thereby cutting off all plate current flow during tube warm-up. The bias is controlled by a 12-V relay, K3, located in the rf input enclosure. Notice that both sides of the coil have rf chokes and disc capacitors ahead of the side wall feedthroughs. When the transceiver is operated, its auxiliary relay contacts are wired so that a contact closure to ground is generated thereby grounding one side of the bias relay coil and the two coax relays.

Cooling of the amplifier is achieved by using one miniature, high-speed muffin fan. The fan is mounted externally on the rear, fixed to the top cover. Direction of air flow is out of the amplifier, with the input path controlled. To gain maximum benefit from the fan, the louvers were taped closed on the inside of the top cover. Specifically, the right side and top right half were sealed. This action forces most of the input air to be pulled through the left-hand louvers into the rf output cage, picking up heat from the 811As and exiting it through the opposite side of the rf cage. The fan's motor cable was equipped with a male two-prong plug for easy removal. Incidentally, the amplifier can be operated with the top removed (hence no cooling) for short periods of time. With the cover removed, full rf input and output shielding is maintained making very easy the *dummy load* adjustments in the metering; bias, relay circuits, etc.

Tune-up and placing the linear on the air is made quite simple with the aid of the built-in relative-power meter. After allowing a nominal tube warm-up of, say, 15 minutes, key the transceiver with the mike gain at a minimum setting. The meter function switch should be placed in the plate current position. Increase the mike gain until plate current reaches about 200 mA.

Do not keep the transceiver keyed for periods longer than 10 to 20 seconds at a time due to the heat generated by the 811As.

After a brief period, turn the function switch to the relative-power position while alternately adjusting the tank circuit and loading capacitors to peak the relative-power output. Now switch back to plate current and increase this value to about 600 mA, which is about the 860-Watt input level with 1440 volts on the plates. This allows for an additional 100 Watts of driving power, keeping the total dc input power slightly less then 1 kW. A retouch of the tank controls may be required at this time using the relative-power position. Typical CW operation on 20 meters shows a plate current of 600 mA with a grid current of about 40 mA.

The amplifier has been in use for several months on both CW and SSB. Although the rig is mostly used for CW, its linearity is acceptable for SSB operation. As with all grounded-grid linear amplifiers, the loading is a bit critical, but after you get the hang of it, operating becomes a pleasure. ■

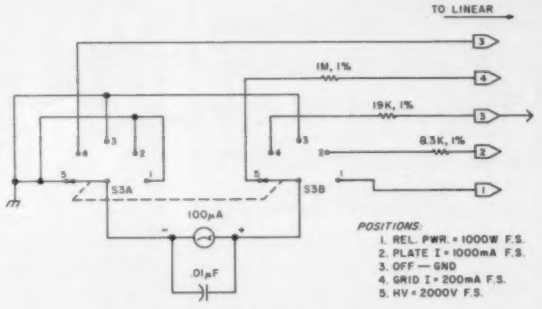

Fig. 3. Meter-function circuit.

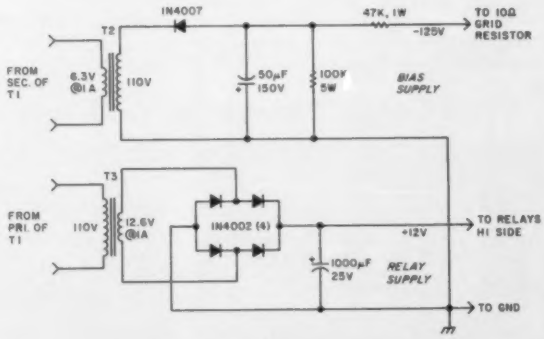

Fig. 4. Bias and relay supplies.

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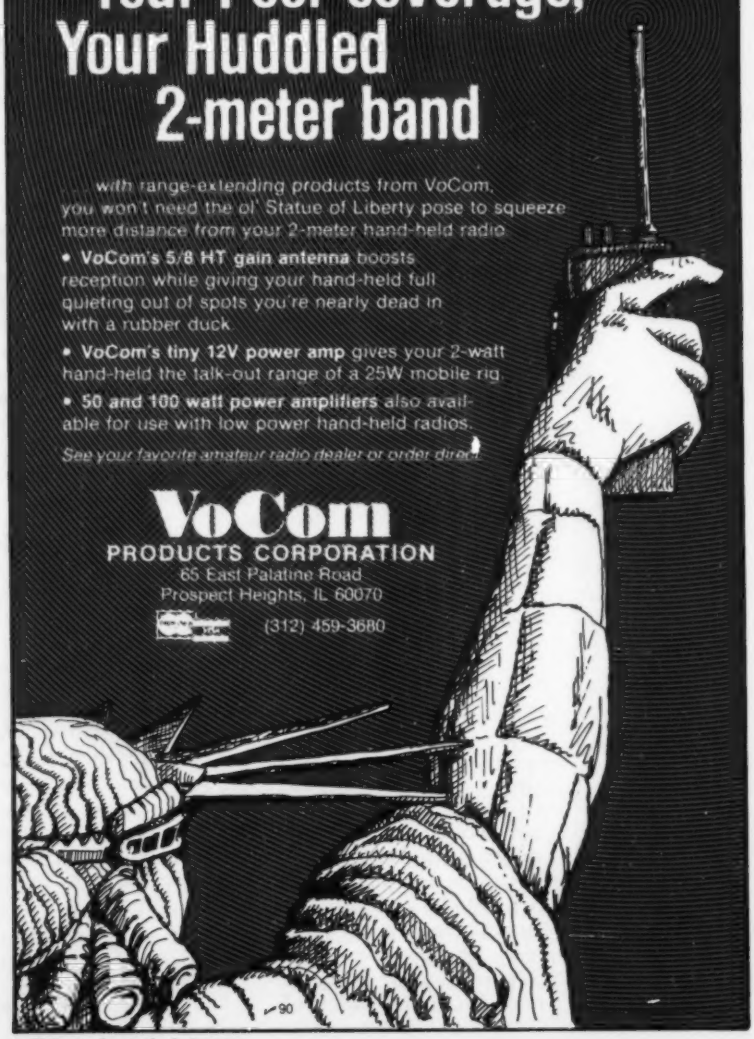

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Controlled Chaos

—getting the most out of state QSO parties

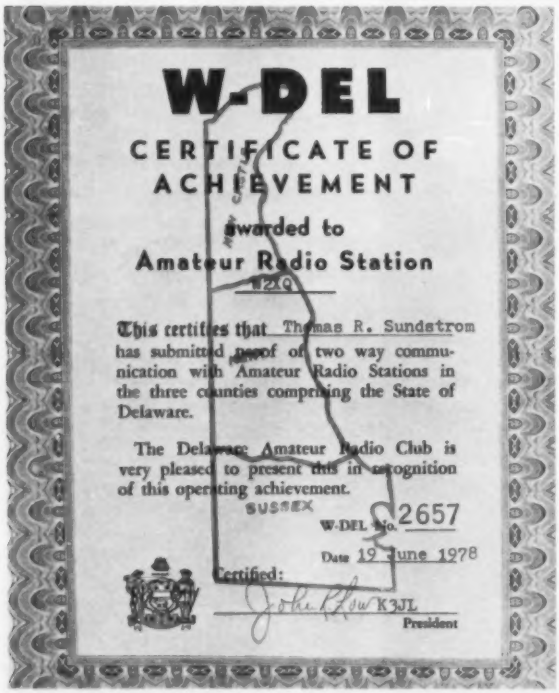
How would you like to be a sought-after station on the low bands? How would you handle a pileup when you, a stateside station in W2- or W4-land, call CQ?

Often the situation is reversed. A rare DX station has probably worked thousands of US stations in all 50 states, so why should he work another W2, W4, or W6? But, once or twice a year, it can be your turn to be the hunted and have the choice of all who call you!

A controlled-fun kind of chaos, not quite as intense as the worldwide DX contests, is found in the state QSO parties. You, in the sponsoring state, are the station being sought by others. It's especially fun if you are in the county that has a small radio amateur population.

State QSO parties occupy relatively little spectrum space. Unlike the big DX contests or Field Day where every band disappears under a barrage of CQs, the state QSO parties tend to cluster around preannounced frequencies in the phone and CW subbands. Unlike the big contests, there is plenty of room for those who choose not to contest.

Table 1 lists all 50 states. Only 32 states have separate QSO party contests, but another 16 are represented in regional QSO parties listed in Table 2. The data listed is obviously subject to change (about 6 contests changed weekends this past year); detailed rules are publicized well ahead of time in *73* and most other amateur radio publications.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One of many certificates available for participating in state QSO parties.

Weekend Activity

All QSO party contests are conducted on the weekends. The data shows state and regional QSO parties in every month of the year except April. May has six contests, September and March have five, and February has four. State QSO parties will not compete with the major international and national contests such as CQ Worldwide or ARRL Sweepstakes.

The hours of operation are *usually* very convenient for those who have worked parts of Saturday or Sunday. Most contests do not begin until midday Saturday, have a rest period from late Saturday evening to late Sunday morning, and end around dinner time Sunday evening. There are, however, some contests that run the full 48 hours, and some others that do not have the Saturday night-Sunday morning rest period, so be sure to check.

The Exchange

The contest exchange

varies from contest to contest. Tables 1 and 2 summarize the exchanges.

Elements include a signal report, a serial number, county, state or ARRL section (see page 8 of any *QST*), or country.

An amateur in a sponsoring state would send a signal report and county, plus a serial number if required. On CW, for example, in the New Jersey QSO party, I would send:

CQ NJ CQ NJ DE W2XQ K
W2XQ DE W2NSD/1 K
W2NSD/1 DE W2XQ
599010 BURLINGTON BK
W2XQ DE W2NSD/1
599001 NH BK
QSL QRZ DE W2XQ K

In this example, 10 is my QSO number; for W2NSD/1, it's number 1. Regardless of band changes, QSO serial numbers continue consecutively and increment by one of each QSO.

Object of the Contest

The object is for in-state amateurs to contact as many other stations as possible, with an emphasis on out-of-state and DX stations. Not all contests permit in-state-to-in-state QSOs. Out-of-state amateurs look only for amateurs in the sponsoring state.

Due to the relatively low number of stations participating (100 or more is a lot), a good deal of comradeship develops. For example, in the 1980 New York QSO party, six New York stations in six different counties ran a roundtable first on 75 meters and then on 40 meters over several hours. Anyone who wandered into the QSO could work W2TU, WB2SJG, WB2KEX, KB2DE, WB2IVX, and WB2IPX within two minutes flat! During slow periods, stations tend to cluster onto a few frequencies and call CQ in turn; as a newcomer answers, all those on the frequency can take turns in working the newcomer.

Contest Scoring

Most QSO party contests are scored by multiplying the number of QSOs times the number of multipliers. For an in-state contester, a multiplier is each different state, or ARRL section, and DX country. If in-state-to-in-state QSOs are permitted, then each county is also a multiplier. For out-of-state contesters, each county worked is a multiplier.

Most contests count multipliers once regardless of the number of bands they are worked on.

For those intending to submit a contest entry to the sponsoring organization, you can see why a rare county is very popular, especially if that station comes on the air in the later hours of the contest and the county has not been previously heard from. The out-of-state stations create one pileup and, if in-state QSOs are allowed, the stack of calling stations grows even larger. That could be you in that rare county picking through the pileup. It's a fun experience.

Other Rules

Most contests permit one station to contact another station once per band per mode. Continuing with the example above, W2NSD/1 and I could work each other on phone and CW on each band from 160 to 10 meters for a total of 12 QSOs. For multipliers, however, I can count New Hampshire only once; W2NSD/1 could count Burlington county only once.

Florida's QSO party is one notable exception to this. The phone and CW entries are compiled separately; the scores are not added together if one station submits two logs.

Another standard rule is that the same in-state station may be worked more than once per band per mode if the in-state station changes counties. For example, in the 1979 New Jersey QSO party, K2NJ/mobile operated on 40 CW from all 21 counties in the course of the weekend; an out-of-state station could have worked K2NJ 21 times. In the 1980 Florida QSO party, I managed to work WD4INQ/mobile on 20 CW in six of the more-than-20 counties he ran through.

State	Month	Weekend Number	Serial Number Required	Out-of-state contesters send: State	Out-of-state contesters send: ARRL Section
Alabama*					
Alaska*					
Arizona*					
Arkansas*					
California	October	1	x	x	x
Colorado*					
Connecticut	December	1	x		x
Delaware	November	2	x		x
District of Columbia	September	3	x		x
Florida*	May	3		x	
Georgia*	May	2	x	x	
Hawaii					
Idaho*					
Illinois*	August	1		x	
Indiana*					
Iowa*					
Kansas	May	3		x	
Kentucky*	September	3	x	x	
Louisiana*					
Maine	July	3	x	x	
Maryland	September	3	x		x
Massachusetts	May	3		x	
Michigan	May	3	x	x	
Minnesota*	June	1		x	
Mississippi*					
Missouri*	November	3		x	
Montana*	October	2	x	x	
Nebraska*	March	2		x	
Nevada*					
New Hampshire	February	2		x	
New Jersey*	August	3	x	x	
New Mexico*					
New York*	May	1	x	x	
North Carolina*	December	1		x	
North Dakota*	March	4	x	x	
Ohio	August	4	x	x	
Oklahoma					
Oregon*					
Pennsylvania	September	3	x		x
Rhode Island	August	3		x	
South Carolina*	February	1		x	
South Dakota*					
Tennessee*	March	4		x	
Texas	January	4		x	
Utah*					
Vermont	February	4	x		x
Virginia*	March	2	x	x	
Washington*	September	3	x	x	
West Virginia	January	3	x	x	
Wisconsin*	March	4		x	
Wyoming*					

*Table 1. State QSO parties. All amateurs send a signal report and amateurs in the sponsoring state send the county. *Some states have both individual and regional or district QSO party contests—see Table 2.*

Operating Strategies

For those wishing to submit contest entries, a high QSOs-per-hour rate is desirable, without forgetting about multipliers. Some contests also award 2 or 3 points per CW QSO, but only 1 point for phone; others award 2 or 3 points per DX QSO. Given those factors, time is probably most effectively spent on 20, 40, or

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80/75 meters. With a decline in the MUF, 10 and 15 probably won't be as profitable in the QSO rate.

The frequencies used in the QSO parties generally are in the sections of the bands where General class licensees are permitted. Some of the larger contests also specify frequencies in the Novice bands for Novice/Technician participants and allow 5 points per QSO to encourage participation.

Obviously, the choice of bands will depend upon the distance between the sponsoring state(s) and the out-of-state participant and the time of day. The season also will have some bearing on the choice. For example, the 1980 Florida QSO party was held in May, and that weekend had very high static levels, rendering 40 and 80/75 meters useless for me in New Jersey; most of my operating time was spent on 20 CW. In the 1979 New Jersey QSO party, 40 meters gave me the highest QSOs-per-hour rate, but 20 meters gave me the most multipliers in other states and countries.

Many more stations seem to be around at the beginning of a contest than at the end. As a strategy, I suggest picking a band and mode to work on multipliers and pick up the distant states early in the contest, then pick up the nearby stations on the lower bands later.

It should be emphasized that power amplifiers and large antennas are not always necessary to "play the game." Properly constructed wire antennas or verticals and a barefoot transceiver can be competitive. Don't forget that most stations only have wire antennas on 40 and 80/75 meters, and compared to 20 are great equalizers. The large antennas and amplifiers probably help in marginal conditions, but then you are probably better off on a lower band with a higher QSO rate anyway.

In Closing

Some of the contest sponsors have a number of good ideas I'd like to see others adopt. More contests should encourage participation by Novices and Technicians. Most sponsors award certificates to first-place finishers in each county and state, section or country, but some combine multi-operator entries with single-operator entries. That's not really fair to the single operators, and separate awards should be given.

Another "nice" idea used by the Tennessee QSO party sponsors is sending a reminder message about the upcoming QSO party to each participant of the previous year's contest. A book of messages is put into the ARRL National Traffic System timed to be delivered about a month before the upcoming contest. The Florida sponsors also use the ARRL NTS to send the book of messages acknowledging receipt of contest entries.

In most cases, an entry consists of nothing more than sending a photocopy of your logbook, as long as all the required data is recorded. Attach a summary sheet showing the calculation of the score, your name, call, and address. Most sponsors also require a checksheet if more than 100 QSOs are made, to ensure that duplicate QSOs have been eliminated from the score calculation.

As a general rule, it also is suggested that you send along a No. 10 business-size SASE for contest results and your certificate, if you qualify.

If you don't feel like submitting an entry, that's OK, too. Just come in for the fun of it. If you are in the sponsoring state, your participation—even if for 10 or 15 minutes—will be appreciated. Figure out what the contest exchange is and jump in for a few minutes whenever you have the time at the beginning, middle, or end of the QSO party. QSO party contesters and county hunters will appreciate it.

See you in the New Jersey QSO party!■

Call area or ARRL division	Month	Weekend Number	Serial Number Required	Out-of-state/region contesters send: State	ARRL Section
2nd call area	February	2		x	
4th call area	August	4	x	x	
7th call area	July	1	x	x	
9th call area	October	2		x	
0 call area	January	1			x
Delta (AR, LA, MS, TN)	September	4	x		x
Rocky Mountain (CO, NM, UT, WY)	May	2			x

Table 2. Regional QSO parties. All amateurs send a signal report and amateurs in the sponsoring states send the county.

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- *All controls on front panel
- *Freq control variable 300 Hz to 2500 Hz will match any rig.
- *LED flashes during decoder operation
- *Operates in line with rig audio—leave in line on OFF/BYPASS
- *Built-in speaker
- *Headphones jack rear panel
- *Battery or AC-adaptor, 9 VDC operation

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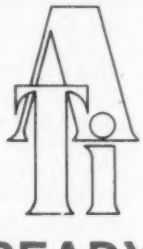

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The General Electric Programmable Clock Radio

—sweet dreams for the broadcast DXer

What, you say, a mere clock radio reviewed in the pages of one of America's foremost communications magazines? Yes, since GE's intriguing, frequency-synthesized Model 7-4885, creatively dubbed the "Great Awakening" by the manufacturer, represents a very positive step in filling a need: that of a *bedside* communications receiver with a built-in clock function. As an avid hobbyist who's a "softie" for *anything* programmable and digital, I knew I had to have one of these gems when the ads first appeared.

A few communications-quality receivers boast clock features. For example, a number of the fine 1950s and 1960s-vintage Hammarlund receivers had built-in clocks, and recent offerings such as the Yaesu FRG-7000, FRG-7700, and Kenwood R-1000 all contain digital clocks which provide some degree of receiver and accessory control, such as turning on the receiver, and an external tape recorder for unattended, late-night DX recording.

To date, however, the author isn't aware of any communications receiver that's also a true clock radio suitable for bedroom use. But the GE offering comes very, very close, and should be of definite interest to the sophisticated AM broadcast band (BCB) DXer and FM-skip listener, as well as to the ham who would like to own a clock radio that's got practically every imaginable feature.

The Model 7-4885 replaces an earlier, but little known GE programmable unit that has been around since about 1977, the model 7-4880. The earlier set was similar, but was channelized to accommodate only the present 10-kHz AM BCB channel splits. The newer version, in addition to incorporating more complex microprocessor-control circuitry, allows the user to instantly adapt the set for the possible adoption of 9-kHz channel spacings by the FCC in the not-too-distant future (more on this later). In a nutshell, the new GE radio is a dream to program and operate, and it especially appeals to individuals such as myself who are fascinated by microprocessor-controlled radio equipment.

The most prominent feature of the GE radio is an easy-to-use calculator-type

General Electric programmable clock radio features precision and convenience not usually found in consumer-electronics products. Microprocessor-based circuitry affords direct keyboard entry of time and radio frequency, memory for six radio stations, multiple sleep/wake-up settability, and fluorescent digital display of AM/FM frequency and time. (Photo courtesy General Electric Company)

touch keyboard used to program the digital timekeeping functions and frequency readouts for AM and FM tuning; there is no tuning knob to be found. Other features include direct digital readout of AM and FM frequencies, up-down scanning (search) of both AM and FM bands, direct keyboard entry of exact time and PLL-controlled radio station frequency, six programmable channel memories, two separately programmable memory "wake-up" circuits, automatic panel brightness control, and dual audible and visible power failure indications.

Essentially, the GE set does everything a conventional clock radio does, plus a lot more. It boasts some unusually sophisticated "fun" features including provisions for going to sleep listening to one radio station and waking up to another, having "his" wakeup alarm set to a certain time and station and "hers" to another time and station, punching-in your own desired interval between the wake-up start of music and the time the alarm jolts you to consciousness, and the ability to program the "snooze interval."

An even more important feature is that once set, all these complicated functions are retained, even through a power failure. Two user-supplied, standard 9-volt transistor-radio-type alkaline batteries provide power for the memory-holding system. This allows the radio to be unplugged and moved around yet keep track of time and maintain programmed radio stations and alarm times. Hold time is good for up to 8 hours using fresh batteries, according to the manufacturer. Should the batteries fail, the automatic power failure indicators will come on-line when power is restored, helping to prevent a late wakeup.

Although this is a sophisticated consumer-oriented radio rather than a true communications receiver, there obviously was some thought given in the design to more than casual use. For example, there is provision for an outside FM antenna for reception in fringe areas, as well as a ground connection. However, there is no provision for connecting an outside AM antenna, though this probably could be done by inductive coupling to the set's internal antenna. A rear-apron headphone jack is provided, a real convenience for late-night DXing. Selectivity, especially on the AM band, is particularly good, with stations standing out with little or no apparent crosstalk when the radio is scanned (stepped) through the band in the preprogrammed 10-kHz intervals. Selectivity is better than is presently required since the radio is designed to accommodate the narrower 9-kHz spacing mentioned earlier, which would place an added demand on good channel separation and "9-kHz whistle" suppression. A slight bit of RFI from the microcomputer circuit was noticeable, especially when scanning through quiet channels, though it was not objectionable.

Perhaps the most forward-looking feature is the user-selectable 9/10-kHz channelization. By sliding a small, screwdriver-accessible switch on the cabinet bottom, the user can adapt the radio to the possible new standard broadcast format. Doing so will alter the spacing increment as the radio is electronically scanned or frequencies programmed in, from the usual run of frequencies from 530 to 1610 kHz, to 531 to 1611 kHz. Under the existing allocations, all AM stations in the US (and most of North and South America, but not the rest of the world) currently broadcast on frequencies with 10-kHz spacing, such as 540, 550, 560, 570, and 580 kHz, and so on. Under the proposed new arrangement using 9-kHz spacing, stations would operate on frequencies such as 540, 549, 558, 567, and 576 kHz, etc.

The compressed channelization scheme could allow as many as 1400 new stations to operate on the standard broadcast band, in addition to the 4000-odd now operating. However, many of the 450 million radios now in homes across the country would be rendered at least partially obsolete since their selectivity would be inadequate to handle the narrowed spacing. Many station owners claim that they would have to spend huge sums to retool their equipment for the new standards. Interestingly, the proposed change by the US may be welcomed by many foreign governments, particularly if other nations in the hemisphere go along, since we are now "at odds" with the 9-kHz spacing used in most other areas of the world. This disparity results in annoying inter-station heterodyning and beating, being most noticeable in coastal areas where transoceanic medium wave (MW) signals are most frequently received.

Living some distance from both the east and west coasts, I didn't try this, but the intrepid MW listener might want to experiment using the radio in the 9-kHz mode to try to snag overseas stations operating on what are presently odd-split channels to us in the US. For example, the radio would be a natural to attempt to receive such DX catches as the 1.5 megawatt, 657-kHz station at Kangnam, North Korea, the 135-kW, 666-kHz outlet in Lisbon, Portugal, Japan's 500-kW powerhouses on 747 and 774 kHz, Istanbul's 1.2 megawatt station on 1017 kHz; or the West German 800-kW outlet on 1593 kHz. The set's stability and sensitivity (although not measured by the author) were found to be quite acceptable and thus suitable for this kind of uncommon bedside DXing. No spurious signals could be detected on either the AM or FM bands. Apparently, GE's engineers thought the set might see double-duty as a DXer's bedside machine, since the radio's instructions even recommend that the user refer to *White's Radio Log*, a periodically-updated listing of all Canadian and US stations referenced by location, frequency, and call letters. The log is published as a part of *Communications World* magazine, a Davis annual.

The next and perhaps inevitable step is for GE or another enterprising manufacturer to crossbreed the programmable clock radio with a scanning programmable portable of the Sony ICF-2001 class for digital bedside shortwave and ham-band listening and wake-up. That step surely isn't far away. In the meantime, one can have a great deal of pleasure playing with GE's flexible and functional programmable, available at discount-stores for under $90. The radio will also make an excellent gift for the inveterate gadgeteer or BCB DXer, since the radio lets him both start and end his day with his favorite hobby.

Only one problem remains: How do I convince my wife to study the not-too-complex instruction manual and remove her wind-up alarm clock from atop the radio? After all, I've offered her the use of the Number 2 "hers" alarm. ■

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PRINTER OUTPUT: Serial TTL selectable Baudot or ASCII (Code converted, regardless of on-the-air mode). Keyboard command on/off.

PRINTER FORMAT: Keyboard programmable from 40 to 140 characters per line.

VIDEO OUTPUT: Standard 1 Volt P-P to monitor or video modulator for use with your television.

SCOPE OUTPUT: Vert. & Horiz. to scope for RTTY tuning aid.

BRAG TAPE: Allows recording off-the-air or for making a long pre-recorded message for later transmission. Keyboard control record/play.

MEMORIES: TEN, 40 character user programmable. Can be stacked for longer than 40 char message. Can be loaded at any time.

TEXT BUFFER: Allows you to "Type-Ahead" up to 1400 characters while receiving (Text entered into the buffer is visible above the SPLIT-SCREEN line for correction).

AUTO-START: Inhibits the display of non-RTTY data.

VIDEO DISPLAY VARIATIONS: Black letters on white background or reversed white on black. NORMAL/ZOOM (twice normal char. size). All keyboard selectable. 40 Characters - 24 Lines.

TUNING INDICATORS: Scope output for RTTY, Audio (pitch) reference tone for CW & RTTY. LED for both.

SSTV TRANSMIT: Outputs standard tones for sending character and computer graphics. Compose full screen and XMT just as in RTTY.

SSTV FORMAT: Three rows of six letters white on black, or black on white.

W R U (who are you?): Automatically responds with call sign whenever a user programmable sequence up to 15 characters is received.

FULL SPEED OPERATION: Morse – 5 to 199 WPM, Baudot – 60, 66, 75, 100, 132 WPM, STD ASCII – 110 & 300 baud, NON-STD ASCII – from 10 to 200 baud.

MORSE SPEED TRACKING: Automatic or speed lock.

SELCAL: Two, 15 character user programmable sequences. Receipt of SELCAL #1 enables the printer and outputs a TTL level. Receipt of SELCAL #2 disables the printer and drops the TTL level for unattended message store (mailbox).

TEST MESSAGES: Quick Brown Fox and RYRY's in Baudot, U*U* in ASCII, VVV in Morse.

SYNC: Transmits "Blank-Fill" in RTTY and BT in Morse when Text Buffer is empty and unit is in transmit. Keyboard command on/off.

T/R (PTT): Fully automatic control of your XMTR via the Push-to-Talk line in both RTTY & Morse.

UN-SHIFT on Space: Automatically shifts back to "LETTERS" upon receipt or transmission of space. Keyboard command on/off.

OUTPUT MODES: CHAR. - outputs each character as typed. WORD - outputs full word when spacebar is typed. LINE - outputs full line when carriage return is typed. BUFFER - outputs full buffer (up to 1400 char) On command.

REAL-TIME CLOCK: Keyboard set, always on screen display, hours, minutes, seconds. Can also be inserted in transmit text buffer by keyboard command.

WORD WRAP AROUND: Prevents splitting words at the end of a line. Works in receive as well as transmit.

DETECTION CIRCUIT – MORSE: Single tone Phase Correlation detector AGC, and 100 Hz wide bandpass filter tuned to 800 Hz center frequency.

DEMODULATOR – RTTY: Dual tone computer enhanced circuit. Keyboard selectable tone pair, HI - 2125/2295 Hz. LO - 800/970 Hz. (Can be preset 500 to 3000 Hz.) Directly compatible with Bell 103 tone pairs for access to remote time sharing computers.

CODE PRACTICE: Random 5 char generator sends at any speed you set via the keyboard. Hand-Key input allows use as a code practice oscillator that will also read your sending!

KEYBOARD DIMENSIONS: 17.8 x 3 x 9.5 inches; weight, 7 lbs.

STATUS DISPLAY can be called up to show the condition and control commands for 20 programmable parameters, such as AFSK tone freqs, UNOS, printer etc. Useful as a "HELP" command in case you misplace the manual. There's also a constant "TOP-LINE" display of Time, Mode, Speed, & Code in use.

CW ID & Normal ID: Two independent 16 character memories for either 2 calls or one normal and one with AUTO-CW ID for RTTY.

MICROLOG

Propagation Prophecy

—you, too, can calculate the MUF

Keith Greiner AK0Q
421 N. Pleasant Hill Blvd.
Des Moines IA 50317

One of the most fascinating attractions of HF communication is the idea that a movement of miniature electrons which we never see produces an invisible signal which travels up into the sky, bounces off some atoms at a height most of us could never hope to reach in an airplane, and then returns to a friendly ear in a distant land. Our voices, our messages, can arrive almost instantaneously, at almost any place in this giant world. Indeed, if conditions are right, it is possible that they could make their way to many distant and exotic lands at the same instant. Then, the real fascination comes when we receive a return message.

This radio skip is a natural and yet unseen wonder of our world which has been the backbone of our worldwide communications. Without it, all frequencies would act much like VHF. The long-distance communications which have saved millions of lives in various world catastrophies never would have been possible. Who knows, satellites might have been invented sooner, and maybe even eleven meters might be a little more subdued.

But try to predict where your signal is going to land, and what shape it's going to be in when it gets there, and you have a fascinating problem.

When I first became interested in this propagation of our radio waves, I sought some practical knowledge I could use to make a reasonable prediction, based on all the information available on a given day. That was about 15 years ago. Then, as now, the major source of information, *The Radio Amateur's Handbook*, advised you to listen to the ARRL's predictions and explained that the topic is so complex that it cannot be covered in just a few pages. I found out that that just isn't so and will show you what I discovered in the next few pages.

One of the major pieces of advice one gets from reading the *Handbook* is that propagation is dependent on the daily solar flux indexes broadcast by WWV. Unfortunately, after they tell you that you should watch the flux, they

Recommended Amateur Band	Calculated MUF in MHz	Signal Destination
40	10	New Orleans
20	17	Merida, Mexico, Guatemala, or British Honduras
15	25	Panama
15	25	Maranon River, northern Peru
10	32	Lima, Peru
10	30	Caldera, Chile
10	33	Buenos Aires, Argentina
10	29	Straits of Magellan
15	22	Antarctica
15	21	Antarctica (a little deeper into the continent)

Table 1. MUFs for a southern path from Des Moines IA, September, 0000 UTC, solar flux 154.6.

don't tell you how you can use that value to substantially improve the monthly predictions published in *QST* and other magazines.

Perhaps you have wondered, as I have, just what it means when the WWV announcers say that today's solar flux is 210, and yesterday they said it was an even 200. Can I use this figure to improve my estimate of the day and hour 10 meters will become useless? Can I use this to help aim my beam in the right direction to add excitement to an evening at the dial? Can I use it to help me find the best circuit to talk to that YL in Moscow, Idaho?

As you've probably guessed by now, I intend to show that predictions of communications circuits to almost any place in the world, short distance or long distance, are about as complex as getting a solid contact with the ham down the street when you both are using a kilowatt. Frankly, if you can tune your transceiver, you can predict a communications circuit MUF (maximum usable frequency) from your shack to any place in the world, for any day and any hour of any month of any year.

The first step you'll want to take, besides reading this article, will be to go back to the *Handbook* to review some of the basic terminology. You'll want to know that the D layer of the ionosphere is the primary absorber of energy, while the E and F layers provide the skip. The E layer, which is the lower of the two "skippers," provides communication links over short hops, while the higher F layer provides the major long-distance skip opportunities.

During the day, the F layer splits into the F_1 and F_2 layers, and the F_2 layer becomes the primary provider of long-distance communication. There are two excellent references on the subject. First, there is the National Bureau of Standards' Monograph 80 on *Ionospheric Propagation*. Unfortunately, it is no longer available through the US Government Printing Office. I discovered my copy buried among some old technical books I bought in 1965. You may be able to obtain a copy at your local library through the interlibrary loan program.

A second reference is the four-volume set called *Telecommunications Research and Engineering Report 13, Ionospheric Predictions*. Sadly, this set is also no longer available through the US Government Print-

	Month	Predicted Sun Spots	Predicted Solar Flux	Actual Maximum Flux	Actual Upper Quartile Solar Flux	Actual Median Solar Flux	Actual Lower Quartile Solar Flux	Actual Minimum Solar Flux	Pct. Deviation of Actual Maximum to Predicted	Pct. Deviation of Actual Minimum to Predicted
1980	Jan	157	200	231.7	217.9	200.5	174.4	153.4	15.6%	23.5%
	Feb	159	202	201.2	175.2	169.5	161.9	139.3	18.7	17.8
	Mar	160	203	249.9	237.3	187.2	162.5	137.3	33.5	26.7
	Apr	156	199	223.1	211.1	201.4	191.9	185.9	10.8	7.7
	May	152	195	292.8	264.6	200.6	181.4	165.7	46.0	17.4
	Jun	145	190	251.5	223.1	188.8	155.1	146.7	33.3	22.3
	Jul	142	187	258.0	235.2	188.4	142.8	130.9	36.9	30.5
	Aug	143	188	232.1	207.6	191.9	173.0	153.8	20.9	19.9
	Sep	142	187	253.3	205.4	182.9	167.7	153.8	38.5	15.9
	Oct	144	189	273.9	255.4	214.9	196.1	177.2	44.9	6.7
	Nov	143	188	253.2	206.1	185.9	172.4	161.6	34.7	16.3
	Dec	146	190	273.0	231.5	209.9	164.6	153.9	43.7	23.5
	0000 UTC WWV Solar flux, September, 1980, including all but seven days of numbers reported:			269				157	44.0%	16.0%
	Calculated estimate of September, 1980, sunspots:			222				113		

Table 2. Comparison of actual vs. predicted solar flux. Predictions are from the Institute for Telecommunication Sciences, as quoted in QST. *Actual data are for 2,800 MHz solar flux reported by the* Solar Geophysical Data Bulletin, *National Oceanic and Atmospheric Administration, Environmental Research Laboratories. Monthly data are from the 15th of the month shown to the 14th of the following month.*

MUF PREDICTION SHEET

Signal Destination Antarctica Date Sept Time 00 UT

Solar Flux ( )WWV (X)160 ( )110 ( )10 = 203 Sun Spot Number 160

Great Circle Onionskin File Number 10 Total Distance 13,500 km

Distance ÷ 4000 km = 3.38 rounded up = 4 *2 = 8 (A)

Total Distance ÷ A = 1,688 = up or down distance per hop

1 Notes	2 Hop Number	3 MUF @ F2	4 MUF 4000 F2	5 Derived MUF F2	6 MUF 2000 E	7 Derived MUF E	8 Greater of Col. 5 or 7	9 Minimum in Column 8	
	1	11	34	22	11	11	22		
	2	13	29	21	10	10	21		
	3	12	34	21	8	8	21	↓	
	4	8	24	16	7	7	16	(16)	

Additional Notes:

Map references: OT/TRER #13
volume 4, pages 290, 291, 314

Fig. 1. This is the work sheet I use to calculate a multiple-hop maximum usable frequency (MUF). When you wish to make an estimate for a day with other than 160 sun spots, you can use separate pages for 110 sun spots, 160 sun spots, and the final estimated maximum usable frequency.

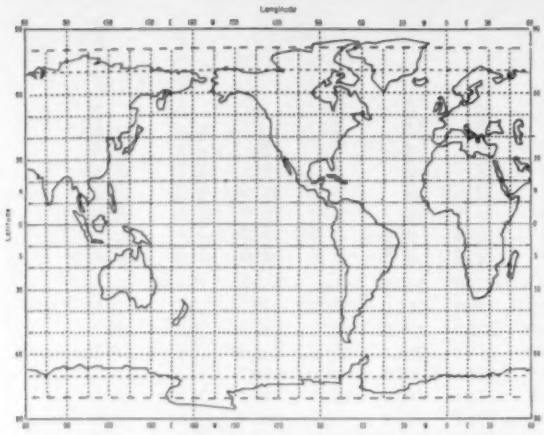

Fig. 2. Modified cylindrical projection of a world map. Use this chart to determine your location and the location of your expected contact. Source: Office of Telecommunications' Telecommunications Research and Engineering Report 13 (OT/TRER 13).

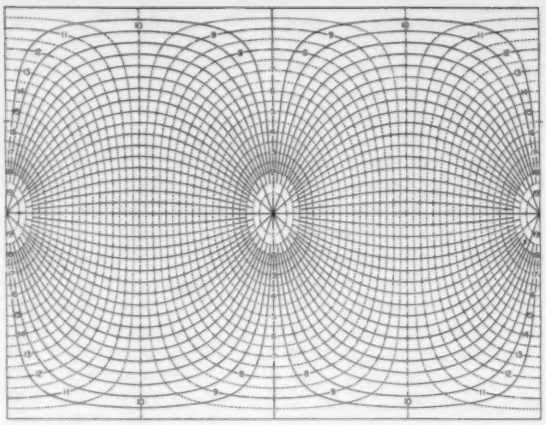

Fig. 3. Great-circle chart centered on the equator for use with Fig. 2. The solid lines represent great circles, while the numbered "dot-dash" lines indicate distances in thousands of kilometers. Use this chart to determine the great-circle distance between two points by using your onionskin paper and drawings like those in Fig. 4. Source: OT/TRER 13.

ing Office. However, there is hope. You can buy a copy of all 1,330 pages for just $12 from the Solar Terrestrial Data Center A in Boulder, Colorado. Unfortunately, the copy is on microfiche, and you'll need to find a microfiche reader at your library or at a friend's business, or perhaps you'll want to purchase your own reader for about $150.

Don't let all those dollars worry you, because included with this article are most of the materials you'll need to get started. In fact, of those 1,330 pages, I found that the whole subject is so simple that everything is explained in the first 18 pages. The other 1,312 pages are simply maps like the ones in Figs. 5 through 7 and 10 through 12. That's 18 pages of material I'll reduce to just a few pages here.

Most discussions of propagation predictions center on predictions of MUF because that is the frequency at which your signal bounces off the highest possible portion of the ionosphere and, therefore, gets you the longest distance with the fewest number of hops. But since amateur frequencies very rarely fall on the MUF, what value is there in knowing the MUF?

The reason for our interest is that the MUF for any given circuit may change as much as 14 to 15 MHz in a very short time. Also, since most of us have only a limited amount of time to spend on the air, the primary question can be that of what stations can I expect tonight if I point the antenna south rather than what time do I need to be on the air to make it to Panama? Table 1 shows an example of this: A midwestern station in the US points his antenna south at 0000 UTC on a September evening.

The table shows ten steps of approximately equal distance between here and Antarctica. Step 1 shows that if I tune up the rig on any frequency less than 10 MHz, I should be able to make a contact in Louisana. Better try 40 meters for that one. The closest available frequency to the MUF of 17 MHz should allow an opening into Guatemala, or the

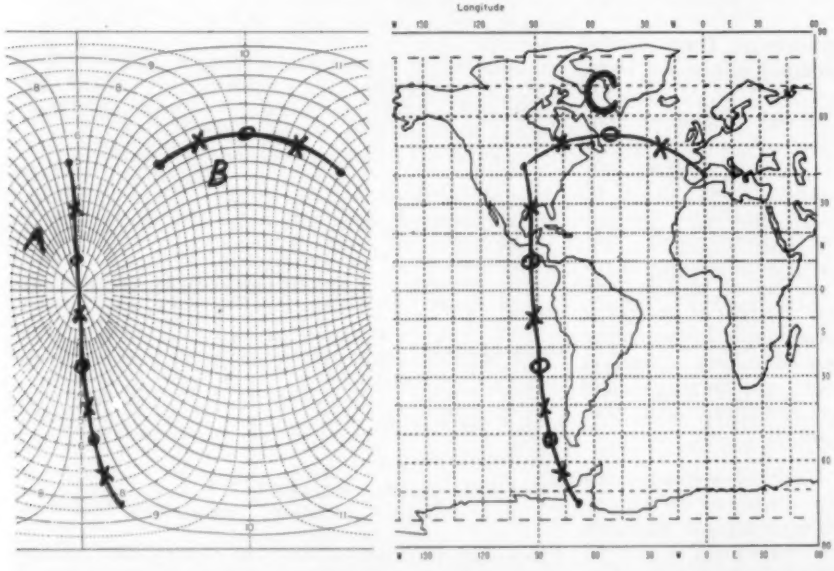

Fig. 4. Lines A and B show the great-circle projections of two paths from Des Moines, Iowa. A is a four-hop path to Antarctica, while B is a two-hop path to eastern Spain. C shows how the paths in A and B appear on a cylindrical-projection map. Source: OT/TRER 13.

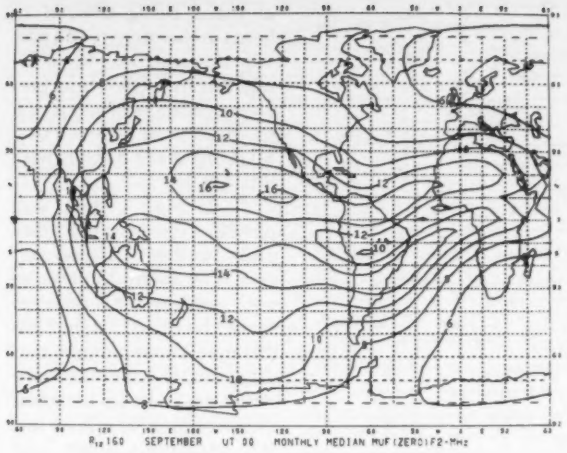

Fig. 5. Monthly median maximum usable frequencies for a signal to reach "zero" kilometers distance from the transmitter via the F_2 layer. This chart is for 0000 UTC, September, and a sunspot number of 160; a solar flux day of 203. Source: OT/TRER 13.

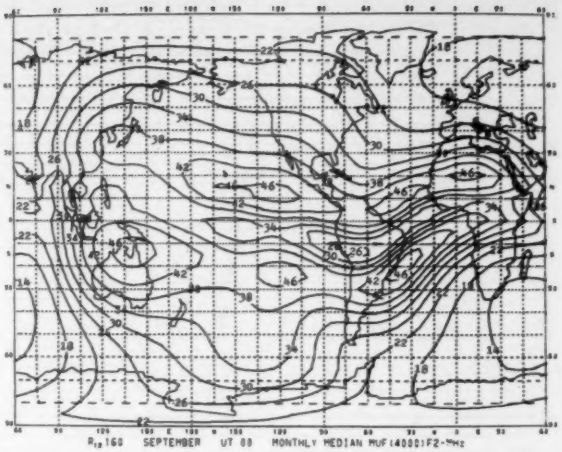

Fig. 6. Monthly median maximum usable frequencies for a signal to reach 4,000 kilometers distance from the transmitter via the F_2 layer. This chart is for 0000 UTC, September, and a sunspot number of 160; a solar flux day of 203. Use this figure along with Fig. 8. Source: OT/TRER 13.

city of Merida, Mexico. If there's a ham operator available in the mountains near Caldera, Chile, I actually might be able to make a contact on 10 meters—might be worth a try. Then, on 15 meters, I could possibly pick up the Maranon River of northern Peru or someone on the continent of Antarctica. That's a pretty good choice of contacts for a single antenna direction and a single hour of the day.

Checking the predictions over several hours would show about how long you can use each frequency to establish a contact to the area shown. Note that it is possible to be extremely specific about the location you may reach. At this point, you have overcome the limitation of most published predictions which show only the general area of the world you can reach and overlook many of the domestic circuits you'll want to use when trying for the closer distances, such as that YL in Moscow, Idaho, we mentioned earlier.

Another limitation of published reports is their inability to allow for an adjustment due to today's solar flux value broadcast by WWV. This can be a rather significant factor. For example, the September, 1980, predictions published in *QST* were based on a predicted median solar flux of 187. In actuality, during the period of time covered by the predictions, WWV reported daily solar flux as high as 269 and as low as 157 at 0000 UTC. This amounts to a maximum of 44% greater than the predicted median and a minimum which was 16% less than the prediction.

Table 2 shows the actual vs. predicted solar flux values sent to me by the Environmental Research Laboratories in Boulder. These daily averages also show some variation from the most currently broadcast figures you will hear on WWV. Even so, for the months shown, the flux varied upwardly about 46% and downward 30.5%. That's a considerable amount of variation from the predicted value and could have a substantial effect on some HF circuits. The procedures I'll outline will show you how to adjust for that variation.

First, there is one more concept we must briefly cover. At any given time, for any given communication link, there may be several MUF values which apply, depending on the ionospheric path you wish to use. These include a MUF for the E layer and F layers for each instance when the signal bounces off the ionosphere. You want to find the lowest MUF for F propagation and the highest of either the F or E MUFs. In the calculations shown in Table 1, the maximum number of hops on the signal's trip to Antarctica was four reflections off the ionosphere, and the F_2 region dominated in all cases.

The 13 steps which follow take you through the estimation process. I suggest that you may wish to read through the steps first and then go back and fol-

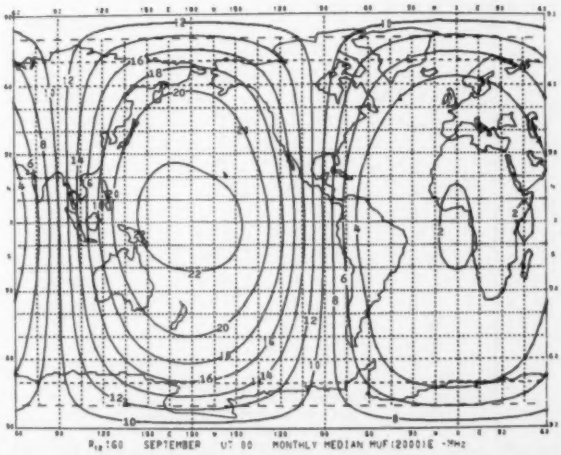

Fig. 7. Monthly median maximum usable frequency for a signal to reflect via the E layer. The chart is for 0000 UTC, September, and a sunspot number of 160; a solar flux day of 203. Use this figure with Fig. 9. Source: OT/TRER 13.

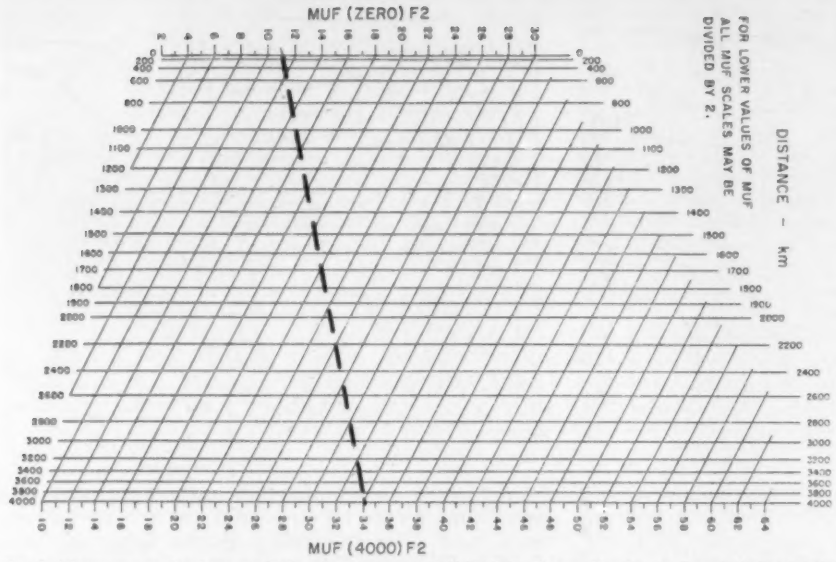

Fig. 8. Nomogram for interpolating between an MUF(0) F_2 (from Fig. 5), and an MUF(4,000)F_2 (from Fig. 6) to determine maximum usable frequencies at intermediate distances. The dashed line shows an example of a situation when the MUF(0) is 11, and the MUF(4,000) is 34. Following the line, we can see the MUF for a distance of 1,7000 kilometers is 22 MHz. Use this nomogram to find MUFS for column five of the work sheet in Fig. 1. Source: OT/TRER 13.

low along step by step. You'll be amazed at how fast you can arrive at a very accurate MUF for your communications circuit for the maps shown.

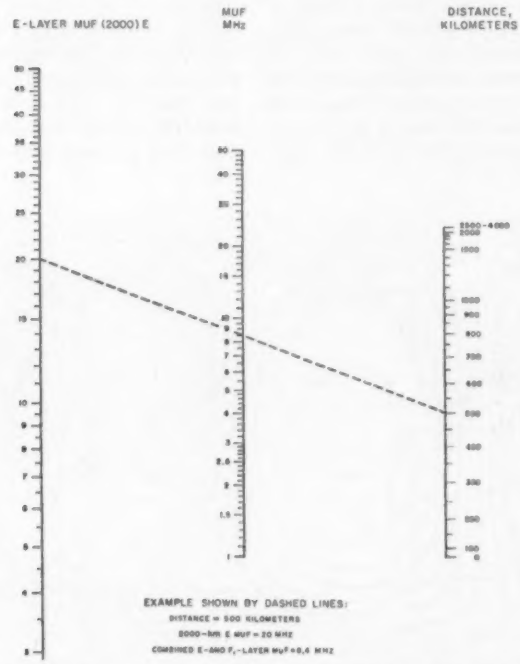

Fig. 9. Nomogram for converting the MUF(2,000)E from Fig. 7 to maximum usable frequencies at other distances. Use this nomogram to find the MUF of E-layer signals for column seven of the work sheet in Fig. 1. Source: OT/TRER 13.

1) Gather some materials together: a piece of onionskin paper or similar paper that you can see through, a ruler, a copy of the work sheet shown in Fig. 1 (I just sketch out my own sheet), and this hour's WWV solar flux value. You'll find the WWV solar flux broadcast at 18 minutes after every hour.

2) Locate your QTH and the city you wish to reach by laying the onionskin paper over the map in Fig. 2 and placing a dot on the two locations. Also draw in the equator line.

3) Move the onionskin paper down to Fig. 3 and line up the equator with the equator in the figure. Slide the onionskin paper to the left or right along the equator, until the two dots lie on the same great-circle line, similar to the east-west route in Fig. 4(B) or similar great-circle lines like the north-south route in Fig 4(A). Now, draw in the great-circle paths as shown in Fig. 4(C). If you wish, you can use one of the azimuthal maps being offered to hams in this step. It can provide an easier way to calculate distances, but may provide a problem when trying to determine the actual MUF on maps shown with this article.

4) In Fig. 3, you will notice some dashed lines and numbers. These tell you how many kilometers your dots are from the center of the chart. To find the distance between your two dots, simply count the number of dashed lines between the two dots. The lines are 500 kilometers apart, and the numbers are 1,000 kilometers apart.

5) Now you need to identify the number of reflections your signal will make off the ionosphere. I use a code here, where an "X" means the signal is reflected off the ionosphere, and an "O" shows where the signal is reflected off the Earth. To find the number of reflections, first divide the total distance by 4,000 kilometers. Then round that number up to the next largest whole number, multiply by two, and finally divide your result into the total distance. This gives you the distance traveled in either an upward path or a downward path. Mark off the upward and downward path lengths on your onionskin, beginning with an X (because your first signal must bounce off the ionosphere) and alternating Xs with Os until all reflection points are found. Note that the first and the last reflection points must always be Xs. For short hops of under 4,000 km, there is only one X at the very center of the path between the two points. Now, you can begin to fill in Fig. 1.

6) Lay your onionskin paper over Fig. 5 to find the MUF at zero kilometers for each point marked with an X. To help you through the first example, I've written the north-south values in on

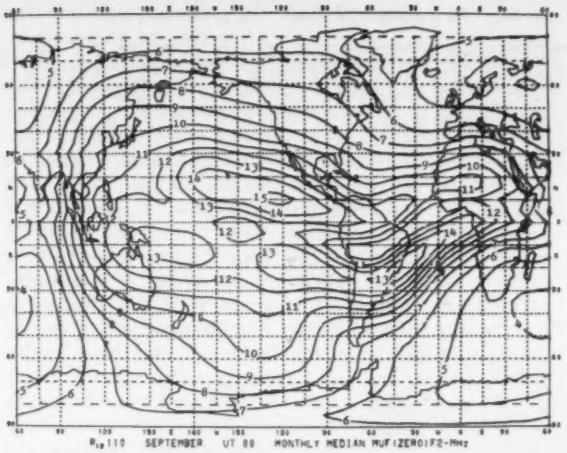

Fig. 10. Monthly median maximum usable frequencies for a signal to reach "zero" kilometers distance from the transmitter via the F_2 layer. This chart is for 0000 UTC, September, and a sunspot number of 110; a solar flux of 154.6. Source: OT/TRER 13.

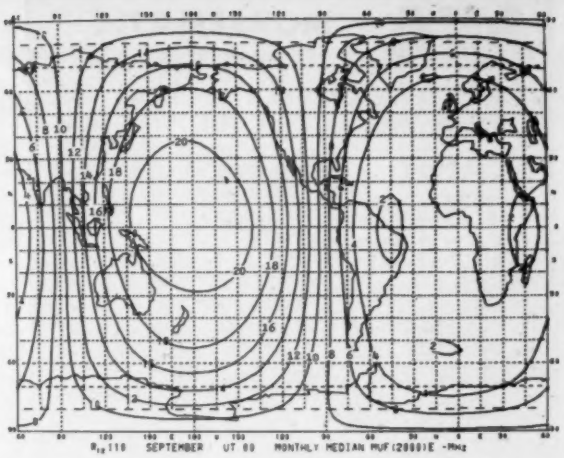

Fig. 12. Monthly median maximum usable frequency for a signal to reflect via the E layer. The chart is for 0000 UTC, September, and a sunspot number of 110; a solar flux day of 154.6. Source: OT/TRER 13.

the table in Fig. 1 under the heading, "MUF 0."

7) Using the onionskin and Fig. 6, identify the F_2 MUF values for each hop and enter them in the table in Fig. 1 under the heading, "MUF 4000."

8) Using the distance between each reflection point, go to Fig. 8 and interpolate the actual MUF you can expect on that particular hop. This interpolation between the MUF 0 and the MUF 4000 adjusts for the angle at which your signal travels to reach each of those hop points. Every reflection point in every path has a different reflection angle.

9) Finally, in your last use of the onionskin paper, lay your paper across Fig. 7 and determine the E layer MUF at each point for a 2,000-kilometer hop. Enter this value into Fig. 1. Then find the actual E layer MUF by using the nomograph in Fig. 9. Note your results in Fig. 1.

10) Now simply compare the F layer MUF value for each hop in column five of Fig. 1 with the E layer MUF in column seven of the same figure for each hop. Select the larger of the two values and put it in column eight. Then select the smallest number in column eight. Congratulations! You have just found the maximum usable frequency for a day on which there are 160 sunspots, or a solar flux of 203. Call this "MUF_{160}."

11) To interpolate the MUF values for days when sunspots are something other than 160, you first go back and do steps six through ten, using the maps for a sunspot number of 110

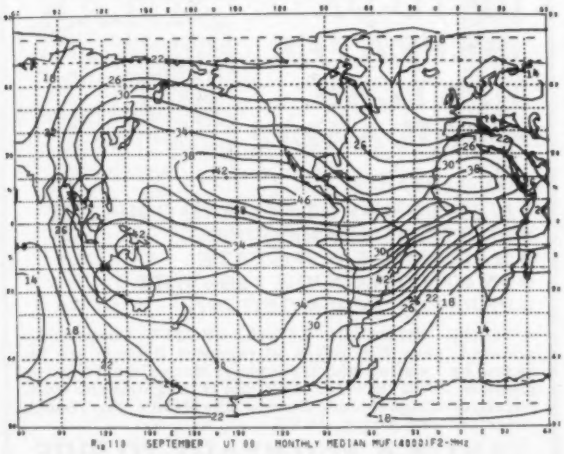

Fig. 11. Monthly median maximum usable frequencies for a signal to reach 4,000 kilometers distance from the transmitter via the F_2 layer. This chart is for 0000 UTC, September, and a sunspot number of 110; a solar flux day of 154.6. Source: OT/TRER 13.

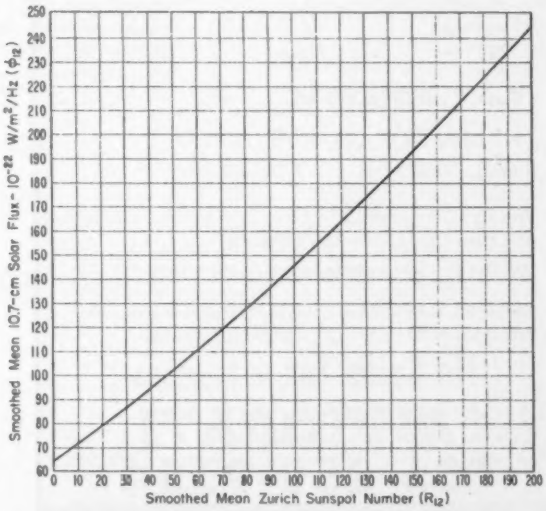

Fig. 13. Relationship between smoothed mean Zurich sunspot number and smoothed mean 10.7cm solar flux. Use this graph to convert WWV's solar flux to the daily sunspot number for use in the formula for adjusting the MUF to today's solar flux.

in Figs. 10 through 12. Call these "MUF_{110}."

12) Take today's reported WWV solar flux value and use Fig. 13 to find today's sunspot number.

13) Plug the sunspot number and your MUF values into the following formula and let your calculator or computer finish the job for you. This little calculation finally gives you the sunspot number for this hour of this day of this month, and for this part of the 11-year solar cycle. $MUF = MUF_{110} + 0.02 (MUF_{160} - MUF_{110})$(today's sunspot number $- 110$).

Note: For days when the sunspot number falls below 110, you would also use maps for a sunspot number of 10, and the formula: $MUF = MUF_{10} + 0.01(MUF_{110} - MUF_{10})$(sunspot number $- 10$).

While it takes 13 complete steps to go through the process, you'll find that after two or three times, you are taking little short cuts here and there which have no effect on the outcome but make the procedure go a lot faster. It's like tuning up your radio. The first time, it goes pretty slow, while the third or fourth time takes just a short while. A good estimate with this procedure can be made within two to three minutes for a multiple-hop situation and about a minute for a single-hop situation. The maps here will get you through the month of September.

Acknowledgement

Figs. 2, 3, and 5 through 13 are from the US Government publication *Telecommunications Research and Engineering Report 13,* OT/TRER 13, by M. Leftin, William Roberts, and Rayner Roisch, volumes 1, 2, 3, and 4. ■

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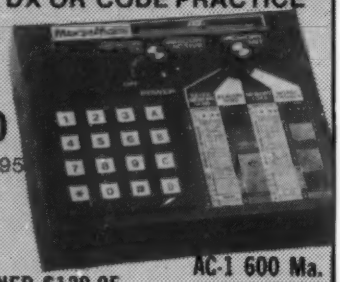

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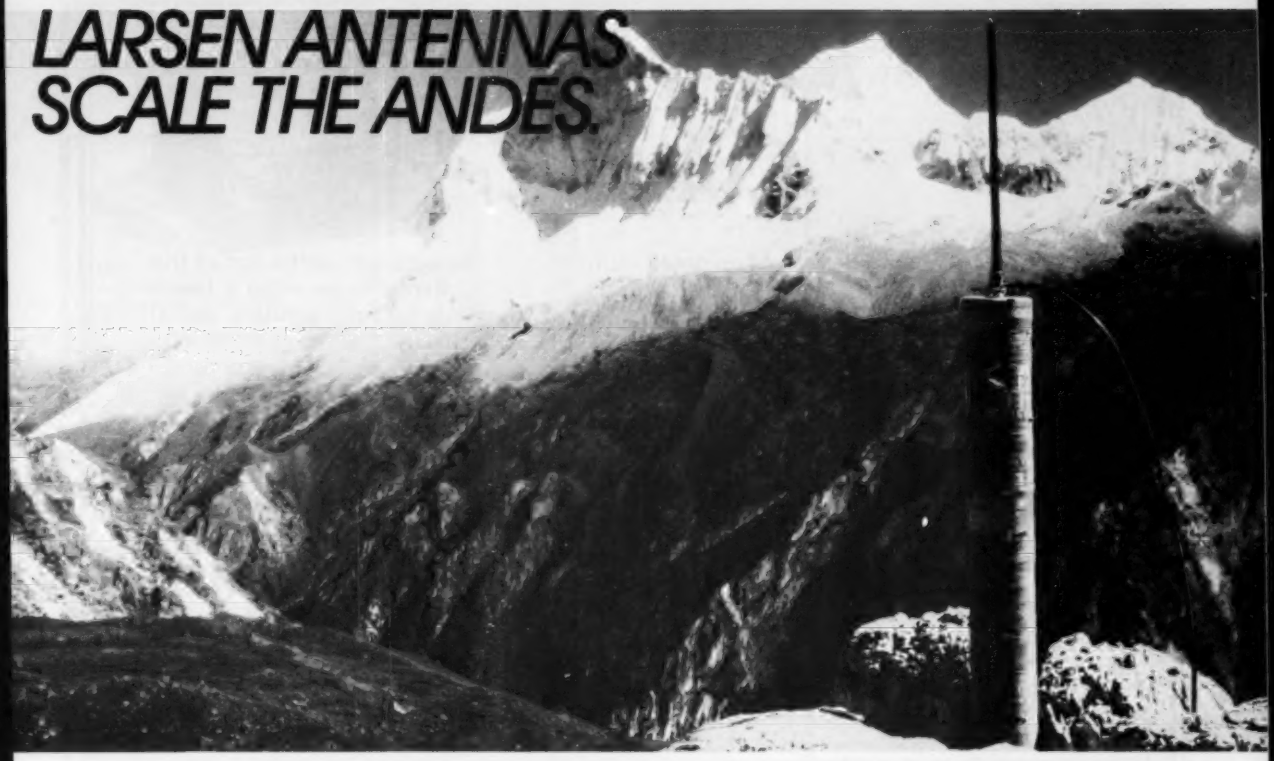

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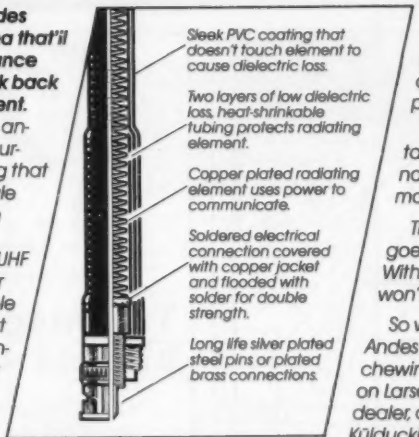
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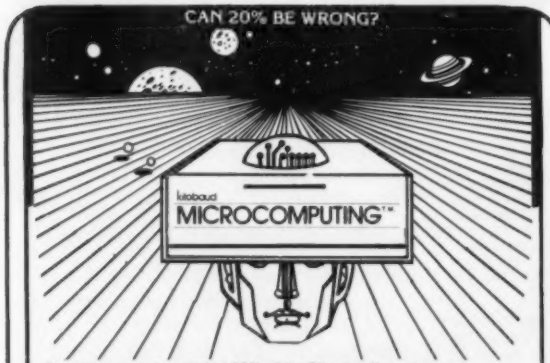

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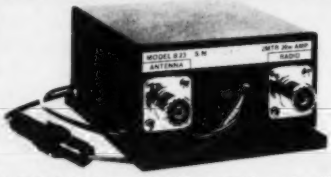

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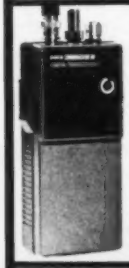

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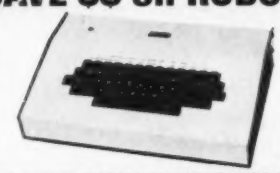

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100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
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Keyer Magic

—unravel the mystery of TTL circuits

In the fall of 1979, I took a course in digital electronics at the University of Arkansas at Little Rock, where I am studying for a degree in engineering technology. During the month-long Christmas break that followed, I decided to see if I could apply what I had learned. An iambic keyer seemed like an ideal project, since the circuit would be sufficiently complicated to be a genuine challenge. Besides, it so happened that my station did not already include a keyer.

You may wonder why anyone would go to the trouble of designing a keyer circuit from scratch, when it would be far easier to build a keyer based on a single IC such as the Curtis 8044. The answer is that designing a circuit based on common, general-purpose

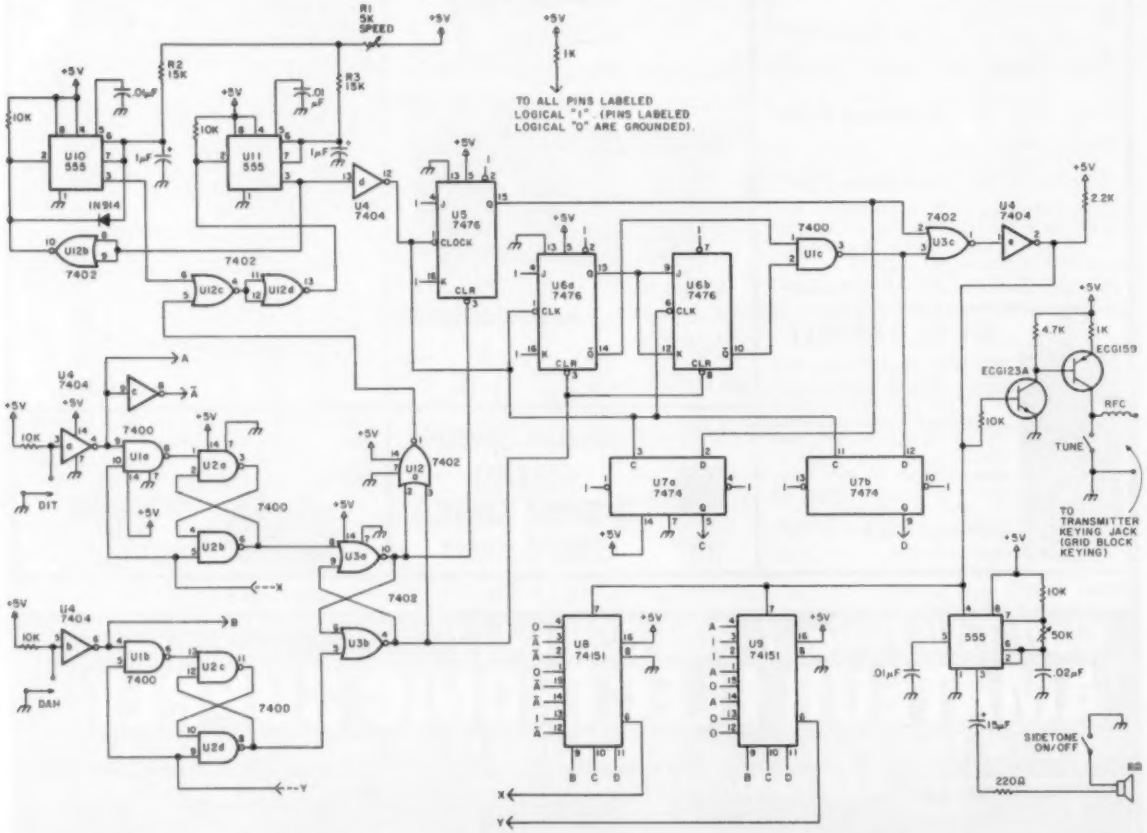

Fig. 1. Complete schematic diagram of the N5DY keyer. Pin numbers not shown are left unconnected.

digital ICs (TTL in this case) is a valuable educational experience for those who are just starting to learn something about digital electronics. I certainly don't claim that my circuit is the ultimate state-of-the-art design, but it works well. Readers who like to experiment with digital circuits may find it interesting.

Design Considerations

Let's begin by defining iambic operation in terms of what the circuit must do. At the end of each code character, a control circuit, or "decision" circuit, as I have chosen to call it, must check several circuit conditions and issue a command as follows:

1) If the dit paddle is on and the dah paddle is off, send a dit.

2) If the dit paddle is off and the dah paddle is on, send a dah.

3) If neither paddle is on, stop sending and reset parts of the circuit where necessary.

4) If both paddles are on, send a character opposite to the one just sent. For example, if the previous character sent was a dit, the keyer would then send a dah.

It is this fourth requirement, of course, that makes iambic keyer circuitry more complex than the circuitry required for a single-paddle keyer. The iambic keyer needs a memory circuit to record the last character sent, as well as control circuitry which can take command of the paddle at certain times.

In addition to the above requirements, there should be no initial startup delay between the time a paddle is depressed and the time a code character is started (other than the extremely small propagation delays in the ICs themselves), and code characters should be self-completing.

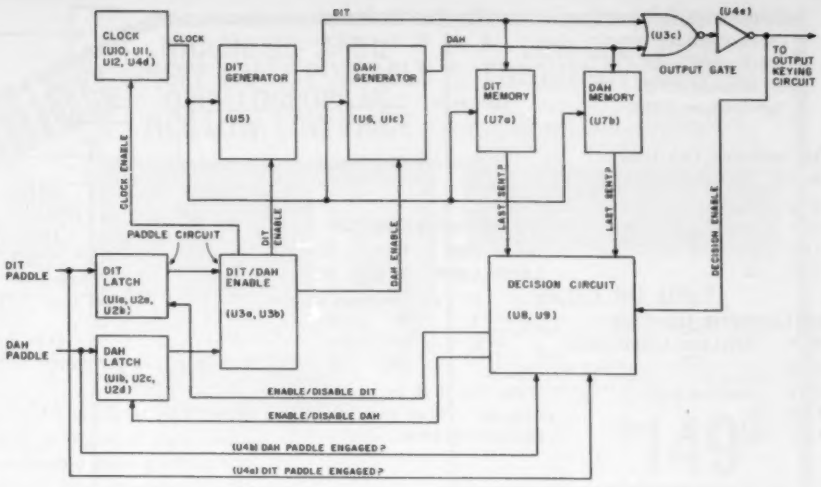

Fig. 2. Keyer block diagram.

The complete schematic diagram of the keyer is shown in Fig. 1. Fig. 2 shows the keyer in simplified block diagram form. (IC pins in the schematic diagram shown connected to "1" are actually connected to +5 volts, and pins shown connected to "0" are connected to ground. The labels "1" and "0" signify that these are logical "high" and "low" connections instead of ordinary power-supply connections. Some texts suggest that these logical "1s" should be connected to +5 V through a 1k resistor, with as many as 25 such connections sharing the same resistor; this is the procedure I have followed.)

Character Generation and Memory

There are many possible ways of generating dits and dahs. An article in the November, 1979, issue of *73* ("Son of Keycoder" by W4RNL) prompted me to start thinking about ways it could be done. In the end I chose a method that is perhaps the easiest to understand.

Let's first consider the dit generator and memory. Dits are formed by feeding a clock signal to a J-K flip-flop wired as a simple divide-by-two counter. When wired as shown in Fig. 3, the J-K flip-flop toggles whenever the clock signal goes from high to low. The output of the dit generator is monitored by a D flip-flop, which is activated by a positive-going clock pulse. Fig. 3 shows the circuit and the resulting waveforms.

Notice that the dit memory persists for half a clock cycle after each dit. The same relationship holds for a dah and the dah memory. The time between the end of a character and the subsequent clearing of its memory is the decision time, labeled t_d in Fig. 3. As will be explained in more detail later, the decision circuit will be activated whenever the keyer output goes low, such as at the end of one of the dits in Fig. 3. However, the final decision (that is, whether to send another character or stop sending) will be based on the conditions that prevail immediately before the character memory is cleared, or in other words, at the end of the decision time. The significance of this is that it gives the operator an extra half-space to get off the paddle before the keyer is committed to sending another character.

The dah generator is based on a synchronous divide-by-four counter. Two of the resulting waveforms are combined with a NAND gate to form the dah waveform, as shown in Fig. 4. (It should be noted here that in the original version of this circuit, the two J-K flip-flops were connected as a ripple counter instead of a synchronous counter, with the result that the keyer wouldn't work properly because a glitch in the dah waveform was activating the decision circuit at the wrong time. I don't intend to go into the details, but it is something that should be pointed out to those who may want to experiment with this circuit.)

The enable lines in Figs. 3 and 4 will enable the generator when high and disable it when low. The paddle circuit controls these enable lines. Whenever one of these enable lines goes high, the clock will also be enabled.

Referring to the complete schematic diagram, note that the outputs of the two generators are combined through U3c and U4e, which act as a simple OR gate.

The Clock Circuit

The clock circuit consists of two 555 monostable mul-

Definition of A, B, C, and D:

A: Dit Paddle (U4a)
B: Dah Paddle (U4b)
C: Dit Memory (U7a)
D: Dah Memory (U7b)

Initial Standby States:

A	B	C	D	X	Y
0	0	0	0	1	1

Dit Latch 1 — Dah Latch 1

Dit Enable 0 — Dah Enable 0

Dit Latch (U1a, U2a, U2b)

A	X	Dit Latch Output (U2b)
0	0	1
0	1	previous state
1	0	1
1	1	0

Dah Latch (U1b, U2c, U2d)

B	Y	Dah Latch Output (U2d)
0	0	1
0	1	previous state
1	0	1
1	1	0

Dit/Dah Enable (U3a, U3b)

Dit Latch	Dah Latch	Dit Enable	Dah Enable
0	0	previous state	
0	1	1	0
1	0	0	1
1	1	0	0

Note that it is impossible for both dah and dit to be enabled at the same time.

Decision Circuit (U8, U9)

Keyer Output	A	B	C	D	X	Y	BCD Address Corresponds to Input on Pin Number:
0	0	0	0	0	1	1	4
0	0	0	0	1	0	0	3
0	0	0	1	0	0	0	2
0	0	0	1	1	1	1	1
0	0	1	0	0	0	1	15
0	0	1	0	1	0	1	14
0	0	1	1	0	0	1	13
0	0	1	1	1	0	1	12
0	1	0	0	0	1	0	4
0	1	0	0	1	1	0	3
0	1	0	1	0	1	0	2
0	1	0	1	1	1	0	1
0	1	1	0	0	1	1	15
0	1	1	0	1	1	0	14
0	1	1	1	0	0	1	13
0	1	1	1	1	1	1	12
1	X	X	X	X	1	1	X

Note: X = don't care. Outputs from pin 6 are inverted data inputs.

Table 1. Truth tables.

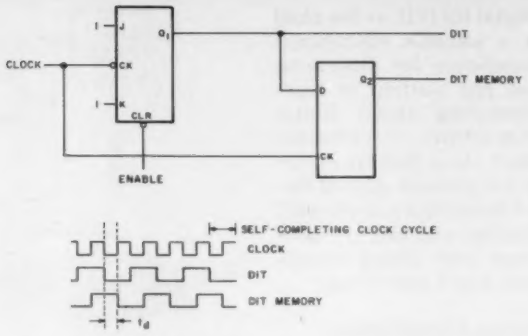

Fig. 3. Dit generator/memory circuit and waveforms.

tivibrators, wired back-to-back. It is basically an adaptation of a single-paddle, 555-timer-based keyer circuit described in *Solid State Design for the Radio Amateur* by Hayward and DeMaw, published by the ARRL. I experimented with several versions of a single 555 astable multivibrator clock circuit, but was not satisfied with any of them. With a single 555 clock circuit, the first clock pulse of a series of pulses will be longer than the pulses that follow. This is an unacceptable characteristic for my keyer circuit, since the clock is enabled and disabled along with the character generators. The twin 555 circuit described here eliminates the problem.

The complete clock circuit consists of U10, U11, U12, and U4d (see Fig. 1). Notice that the dit and dah enable lines are inputs to gate U12a. Initially, both 555 outputs (pin 3) are low, and both timing capacitors are discharged. A high signal on either enable line will trigger U11, which in turn triggers U10 through gate U12b. However, the diode in the circuit prevents the timing capacitor of U10 from starting to charge until after U11 has finished timing out. The clock circuit cannot be retriggered until after the output from U10 has returned to the low state. The result is a waveform that is entirely self-completing, with a duty cycle of approximately 50 percent with the component values shown in Fig. 1. At the end of one complete cycle, another cycle will be generated if an enable line is still high.

Readers who are unfamiliar with the 555 timer should consult *The 555 Timer Applications Sourcebook, with Experiments* by Howard M. Berlin.

The resistor and capacitor values shown will allow for code speed adjustments from approximately 15 to 35 words per minute. Readers who decide to experiment with different values should remember that the timing capacitors must be able to charge to two-thirds of the supply voltage in order to reset the timer. The safest bet would be to make R2 and R3 at least three times larger than the maximum value of R1.

The actual clock output is the inverted waveform of pin 3 of U11, which means that the clock waveform will begin with a high-to-low transition whenever an enable line goes high. This is necessary to meet the design requirement that there should be no initial startup delay between the time a paddle is depressed and the time a code character is started.

The fact that the clock waveform is self-completing means that two code characters cannot be separated by less than one space, regardless of how the paddles are manipulated. (See Figs. 3 and 4.)

Decision Circuit

The decision circuit is based on two 74151 1-of-8 data selectors (U8 and U9 in Fig. 1). Each chip has eight data-input pins and three address pins; three address pins allow for eight possible address combinations (000 to 111). There are two output pins: a data output and an inverted data output. In addition, there is a chip-enable pin (pin 7) which must be held low for normal operation.

One of the eight data inputs is selected to appear as the data output according to the address on the address pins. In Fig. 1, the data inputs to the 74151s are shown on the left side of each IC. They are arranged in order from top to bottom, starting with number 0 (for address 000) and ending with number 7 (for address 111). Note that the IC pin numbers do not correspond to this order. In this keyer circuit, the inverted data output (pin 6) is used. Pin 6 is driven high whenever pin 7 goes high, regardless of the condition of the address pins.

When the output of the keyer goes low, the decision circuit examines the following four circuit conditions, labeled A, B, C, and D:

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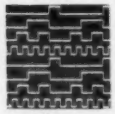

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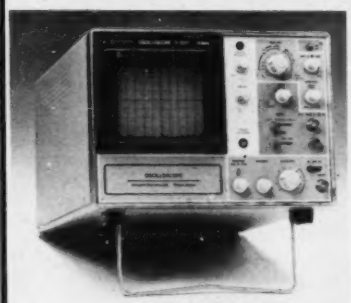

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A: Dit paddle. High if the paddle is on, low if off (from U4a).

B: Dah paddle. High if the paddle is on, low if off (from U4b).

C: Dit memory. High if the last character sent was a dit (from U7a).

D: Dah memory. High if the last character sent was a dah (from U7b).

There are sixteen possible combinations of A, B, C, and D. Four of these conditions (where C and D are both high) will not occur in normal circuit operation, but since they might turn up when power is first applied to the circuit, we must account for them to make sure the circuit doesn't get locked out when the power is applied.

Conditions B, C, and D are used to form the data-select address. Condition A, along with its complement, acts as a variable input to some of the data-input pins. There are two decision-circuit outputs, labeled X and Y, which determine what the keyer will do next. X and Y affect the state of the dit and dah latch circuits, respectively. The complete truth table for the decision circuit is included in Table 1.

The reader should refer to Don Lancaster's *TTL Cookbook* for an excellent discussion of how to design logic circuits with the 74151 IC.

Dit and Dah Latch and Enable Circuits (Paddle Circuit)

The state of the dit and dah paddles is sensed by separate dit and dah latch circuits, which also sense the state of X and Y, respectively. The dit latch consists of U1a, U2a, and U2b, with an output from pin 6 of U2b. The dah latch consists of U1b, U2c, and U2d, with an output from pin 8 of U2d (see Fig. 1). The truth table for these latches is included in Table 1.

The outputs of the dit and dah latches serve as inputs to the dit/dah enable circuit, which consists of U3a and U3b. This circuit controls the dit and dah generator enable lines; the truth table is included in Table 1. The most important feature of the dit/dah enable circuit is that it is impossible for both enable outputs to be high at the same time.

Basically, I designed the paddle circuit to allow the X and Y decision signals to override the paddles and force the dit (or dah) latch high at critical times. When the operator is off the paddle, the X and Y signals will reset the latches to their standby states (see Table 1), which, in turn, forces both dit and dah enable lines low.

An Example of Circuit Operation

Fig. 5 shows the various logic waveforms that result when the dit and dah paddles are manipulated to create the waveforms shown for A and B. The resulting code output is the letter "F". (It should be noted that this is by no means the only way to form the letter "F".) Hopefully, Fig. 5 is a picture worth a thousand words. Table 2 is a step-by-step analysis of the waveforms at various critical times. All of the action described in Fig. 5 and Table 2 is based on the complete truth table selection of Table 1. The notes in Table 3 on the critical times noted in Fig. 5 and Table 2 should be of some help.

Additional Circuit Notes

The keyer output circuit shown in Fig. 1 is based on the circuit shown in the *Radio Amateur's Handbook* (1980 edition) for the Accu-Keyer. It is intended for use with transmitters with grid-block keying. Many variations of this circuit have appeared in ham magazines. Take your pick! The choice of transistors was dictated by what was in my junk box, but I checked the voltage rating of the PNP output transistor before I used it. My transmitter has a grid-block voltage of −55 V. The ECG159 transistor is rated for a maximum collector-to-emitter voltage of 80 V, and a maximum collector-to-base voltage of 80 V. Your transmitter may have a grid-block voltage that is too large for this transistor to handle. The safest bet would be to use a 2N5401 or equivalent. The tune switch in the output circuit is actually my old straight key.

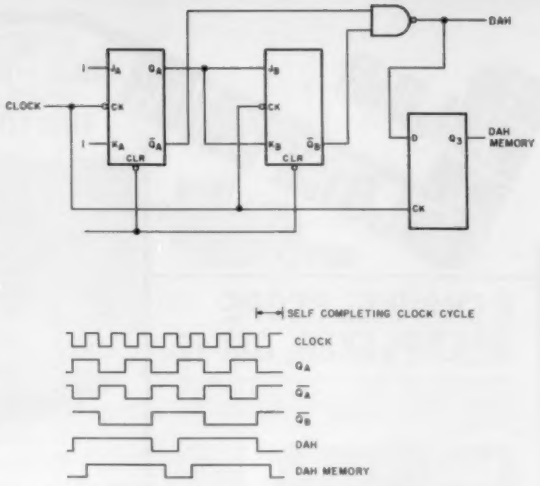

Fig. 4. Dah generator/memory circuit and waveforms.

The sidetone oscillator is a standard 555 timer circuit which has appeared in ham magazines many times. Once again, component values were dictated by my junk box. Two improvements could be made: (1) Substitute a 1k potentiometer for the 220-Ohm resistor in series with the speaker to provide for volume control, and (2) change the 50k tone control to a 100k potentiometer to provide for a greater range of tone control.

I am using a Radio Shack variable dc power supply to power the keyer, which draws nearly 200 mA of current. If I decide to build a fixed 5-V power supply for the keyer, I will make it at least a 1-Amp supply so it can power additional proj-

	Circuit Conditions						Results			
Time	Keyer Output	A	B	C	D	X Y	Dit Latch	Dah Latch	Dit Enable	Dah Enable
initial setup	0	0	0	0	0	1 1	1	1	0	0
t_1	0	1	0	0	0	1 0	0	1	1	0
immediately after t_1	1	1	0	0	0	1 1	0	1	1	0
t_2	0	1	0	1	0	1 0	0	1	1	0
t_3	0	1	0	0	0	1 0	0	1	1	0
t_4	1	1	0	0	0	1 1	0	1	1	0
t_5	1	1	1	1	0	1 1	0	0	1	0
t_6	0	1	1	1	0	0 1	1	0	0	1
t_7	0	1	1	0	0	1 1	0	0	0	1
t_8	0	1	1	0	1	1 0	0	1	1	0
t_9	0	1	1	0	0	1 1	0	0	1	0
t_{10}	1	1	0	1	0	1 1	0	0	1	0
t_{11}	0	1	0	1	0	1 0	0	1	1	0
t_{12}	0	0	0	1	0	0 0	1	1	0	0
t_{13}	0	0	0	0	0	1 1	1	1	0	0

Table 2. An aid in interpreting Fig. 5.

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t_1: X and Y will always be forced high when the keyer output goes high.
t_2: End of first dit.
t_3: Clear dit memory.
t_4: See note for t_1.
t_5: Operator presses dah paddle. B = 1 and Y = 1 will force the dah latch low, but since both latches are low, there will be no change in the enable lines.
t_6: Output goes low; decision circuit enabled. The decision circuits sees A = 1, B = 1, C = 1, and D = 0, resulting in X = 0 and Y = 1. This causes the dit latch to go high and the dah latch to go low. This, in turn, forces the dit enable low and the dah enable high.
t_7: Clear dit memory.
t_8: Analysis similar to that of t_6, except that this time the dit enable goes high and the dah enable goes low.
t_9: Clear dah memory.
t_{10}: Operator releases dah paddle.
t_{11}: Output goes low. Initially, the operator is still on the dit paddle, so the circuit prepares to send another dit. However, the operator has until t_{13} to get off both paddles to stop any further character generation.
t_{12}: Operator gets off the dit paddle in time to stop the keyer. The decision circuit now sees A = 0, B = 0, C = 1, and D = 0, which ends up forcing both enable lines low.
t_{13}: Clear dit memory. The circuit will now be reset to initial standby states.

Table 3. Notes on critical times.

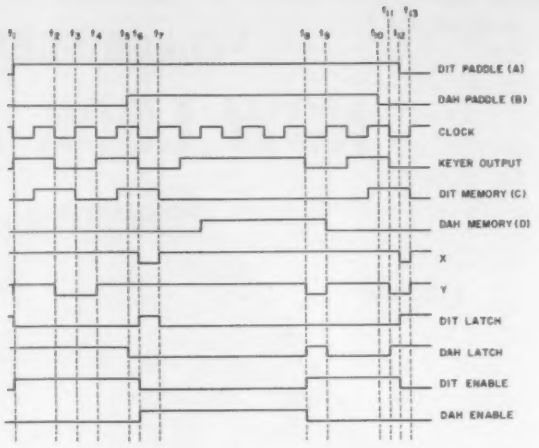

Fig. 5. An example of circuit operation.

ects. The power supply for a TTL circuit must be well-regulated, of course.

This is a good place to mention that the +5-V line in any TTL project should be bypassed to ground with small despiking capacitors distributed uniformly around the circuit board. About five 0.01-uF disc capacitors is about right for this project. Some experts recommend more stringent measures. The *TTL Cookbook* is a good source of information about this aspect of building TTL circuits.

I assembled most of the keyer on a perforated circuit board using wire-wrapping, but I designed a layout for an etched circuit board for the clock circuit.

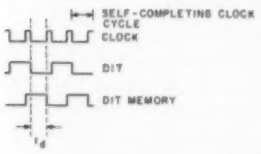

Fig. 6. Decreasing the duty cycle of the clock waveform will increase the decision time. Compare these waveforms to those of Fig. 3.

The best way to build a circuit like this one depends on your personal preference, of course. As of this writing, I have still not decided exactly what type of cabinet the keyer should be housed in. In the meantime, the assembled but exposed circuit has been set up on my operating table and connected to my Bencher paddle. I have used the keyer for many hours of off-the-air practice and am completely satisfied with its operation.

The final test was to connect the keyer to my transmitter to see if it would actually do the job. With the transmitter operating into a dummy load, the keyer worked flawlessly. With the transmitter operating into an antenna, however, the keyer would sometimes act up. Subsequent tests with a dip meter revealed that my rf-in-the-shack problem was worse than I had thought. The dip meter reacted strongly when brought near the coaxial transmission line, the rotator cable, equipment ac line cords, and the cable connecting the keyer to the transmitter.

Part of the solution to this problem was to add a small rf choke in series with the output from the keying transistor, as shown in Fig. 1. I also wrapped the power supply ac line cord around a ferrite rod from an old AM broadcast band receiver. These measures cured the problem as far as the keyer is concerned, and I am now able to use it on the air with no problems. Housing the keyer in a grounded metal cabinet might provide all the necessary shielding. Obviously, I will have to investigate my rf-in-the-shack problem further. The amount of rf-proofing you would need for this keyer circuit—or any other keyer circuit—would of course depend on how much rf is in your shack.

Final Comments

There are two books that you should definitely consider obtaining if you intend to do any experimenting with TTL ICs. The first one is the *TTL Cookbook* by Don Lancaster, which I have referred to in this article. The second one is *The TTL Data Book* by Texas Instruments. It is easy for a mistake to appear in a published circuit despite all efforts to avoid it, so anyone who intends to build such a circuit based on TTL ICs will find it helpful to have a copy of *The TTL Data Book* to check pin numbers and truth tables.

Experimenting with digital circuits such as this keyer can be a lot of fun, in addition to being educational. You ought to give it a try, if you haven't already. If this article encourages someone to get started, it has served its main purpose.

There is one more thing I would like to mention, which could probably come under the heading of second thoughts. A close look at the waveforms in Fig. 3 shows that the decision time could be increased or decreased by adjusting the duty cycle of the clock waveform. For example, Fig. 6 shows how a 25-percent duty cycle would increase t_d from half of a space to three-fourths of a space. The duty cycle can be reduced by increasing the RC time constant of U11, decreasing the RC time constant of U10, or a combination of both. Of course, these changes will also affect the speed range. I have not made any changes in my clock circuit, but since some keyer buffs may feel that a longer decision time is desirable, I thought I should point out how it could be accomplished.■

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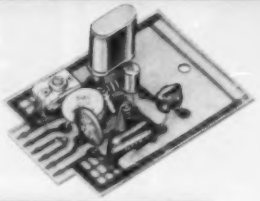

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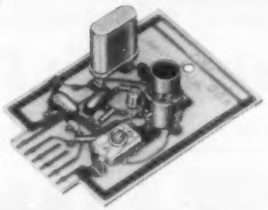

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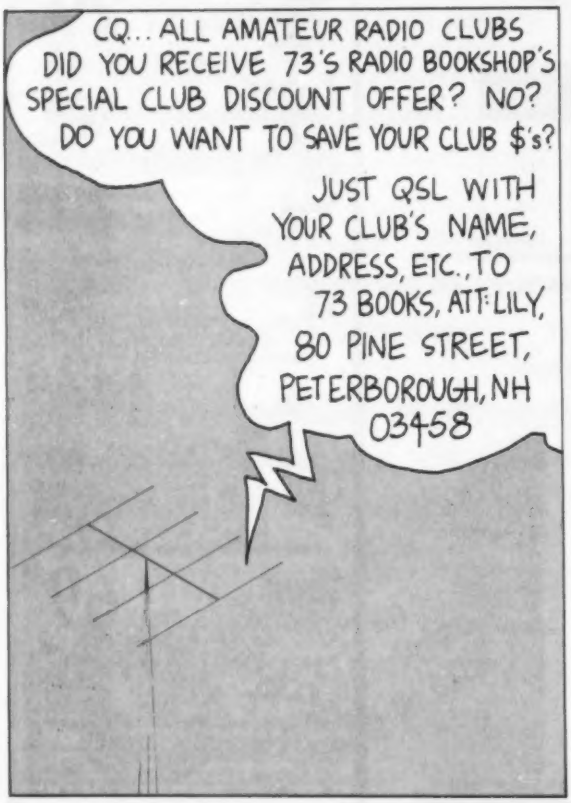
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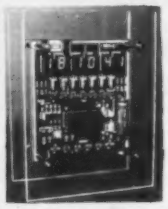

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The Contest Cookbook

—basic strategy and tactics

A contest QSO differs from a regular QSO in that it is short and in that a particular message must be exchanged. The techniques of getting into a contest QSO are similar to those used to initiate a regular QSO or, especially, a DX QSO, but they are generally performed at a higher rate of speed. Thus it is not all that difficult for any active operator to join in the contest fray *once he has read and understood the contest rules.* However, to do well in a contest (and this can mean anything from surpassing your own previous best score to actually winning the contest) takes some knowledge, experience, and work.

This article will attempt to add to your knowledge by suggesting strategies and techniques which have worked for successful contesters in the past. More important, though, through your own experience you will come to know: (1) yourself (your capabilities and limitations as a contest operator); (2) your station (its capabilities and limitations in any particular contest situation), and (3) propagation (both the basic patterns in your particular geographical location and the recent fluctuations in this pattern). According to W3ZZ and others, this combination of experience and knowledge plus *practice, practice,* and more *practice* will make you the best contester you can be.

The Basic Goal of Contesting

Enough of the philosophy—though it is tried and true and should not be neglected, it makes dull reading! Let's look at the basic goals of a typical contest operator. Besides having fun, he usually tries to make the best possible score in the time available. To do this, he must make as many contacts as he can. Many contests are scored by multiplying total contacts by a "multiplier" factor (multipliers will be discussed elsewhere in this article). For now, let's focus on making contacts, the most basic goal in contesting.

Each contact consists of an exchange of some standardized message, and only a limited amount of time is available in which to make these contacts. Therefore, a basic strategy for achieving a better score is to speed up the rate of message exchange or, in other words, to improve your ability to transmit and receive rapid communications through (typically) heavy QRM. Another basic strategy is to minimize the time between contacts, to maximize the *rate* at which contacts are made.

The Exchange

Very little can be said here about improving the receiving end of the exchange other than to urge practice. Upgrading your station equipment may also help, but don't underestimate your own ability to compensate for less than ideal gear. Believe it or not, the combination of the human ear and brain is the best audio filter available today, and it is extremely sensitive as well. Practice will maximize your own amazing capabilities.

On the topic of sending, more may be said. Let's take a simple example that is known to almost everyone who has dabbled in contesting: the ARRL Field Day exchange. All one needs to get across in a Field Day contact is his call, class, and ARRL section. To do this as rapidly as possible, send each piece of information once:

CW: "W6XYZ/6 1C EB de WB6CEP/6 K."

PH: "W6XYZ portable 6, 1C East Bay from WB6CEP mobile 6, over."

Notice how clear but brief the above message is. Repeat calls or parts of the message on the first exchange only if the station you are working is very weak or if its operator does not sound as though he knows what he is doing. For most contacts, though, send each piece of information just once, and you'll be surprised how often that is all that is needed. If someone does ask for a repeat, be sure to repeat only what he is missing. In other words, if you are asked "What's your section?", just give the section (in the above example: "East Bay"). If that still doesn't get through, then repeat the section several times—plus your callsign to assure the other operator that he is listening to the correct signal. On phone, it really does help to use phonetics. The standard ICAO phonetics, or other commonly used phonetics, are highly recommended. "Whiskey 2 Fuzzy Wuzzy Gorilla" (or whatever) is an attention-getting crack-up only if W2FWG has a good signal; otherwise it's usually a waste of time.

The above method is not always best, and as you become a more experienced contester, you will gain the ability to sense how much of the exchange should be sent and how often, in any given situation. The point is that the shorter you make your messages, the more

contacts you are likely to make.

The other major comment regarding the sending of exchanges is pretty straightforward. Improve your sending ability so that you can send your exchange as fast as the person you are working can copy. Estimating just how fast the other operator can copy is a skill that comes only with experience—but if you cannot send that fast, such an estimate will be less helpful. Practice!

Improving the Contact Rate: CQ vs. Search-and-Pounce

Now let's look at the concept of improving score by increasing rate. The easiest way to "keep the rate up" is to call CQ and get others to answer you. To accomplish this effectively, a loud signal is normally required. A powerful transmitter plus fancy, high-gain antennas on big towers will give you a loud signal, but this is a prohibitively expensive solution for many. However, even a so-called "little gun" can be a big signal at certain times, on certain bands, and into certain geographical areas. When any of these conditions holds and people are there to work, by all means call CQ regardless of what kind of signal you have at your command.

At the beginning of the typical contest, "big guns" will call CQ and be answered by those with weaker signals. An exception is where some types of stations are rarer than others; for example, an operator in a rare country may have success calling CQ with a relatively weak signal. For the majority of stateside contesters in most contests, however, the big guns will be the initial CQers. As the contest wears on, the weaker signals will have worked the big guns and will be looking for new stations to contact. At this point, the successful little gun will search the band for a relatively clear frequency that still has some contest activity near it and try a few CQs there. If it works, he should continue to call CQ; if not, he should go back to calling others. Towards the end of the contest, the big guns will have run their pileups dry. If a little gun calls CQ then, he is very likely to attract big guns hungrily searching for that one additional contact.

As the contest progresses, band conditions will fluctuate. If the little gun who is calling others suddenly finds that he is getting answers on the first call to the stations he is working, this indicates good propagation conditions, though often to only a particular part of the US or the world (depending on what type of contest it is). If that particular part is at all heavily populated with contest-oriented amateurs, he should shift to a clear frequency and try some CQs.

Certain bands tend to be better for weak-signal CQs than others. The higher bands—fifteen and ten meters—are very good when they are open. Little guns should keep a close watch on these bands for good openings which will allow them to call CQ—and get answers!

Finally, even a little gun will be quite loud locally in a domestic contest, especially on 40 and 80 meters. An occasional CQ will often produce short "runs" or "strings" of contacts with local operators, especially when the little gun is a fresh signal on the band.

When calling CQ fails, one must answer the CQs of others or suffer a drastic drop in his contact rate. This method of making contacts is commonly referred to as "searching-and-pouncing" (S & P). One searches the band for a station he hasn't worked yet, then pounces on that station and gives a call. Very skilled operators can make QSOs almost as rapidly by searching-and-pouncing as by calling CQ, but it is a more difficult technique to master and requires greater operator effort. Again, practice is important.

Let's first consider the "search" portion of the search-and-pounce method. You want to find a station that you have not yet worked, preferably one that is just finishing a "CQ Contest" or "QRZ Contest" as you tune across it. A loud station will be easier for you to copy—but it may have more search-and-pounce types calling it, so take your choice. A fast, smooth operator will probably work you sooner than a slow and/or unsure one.

While searching, be sure to tune across the entire portion of the band in which there is contest activity. Stations on the fringes may be easier to work because the competition is less. The bug guns tend to congregate near the low end of the band in major CW contests and DX phone contests, while during major domestic phone contests, the action is heaviest near the bottom end of the General class phone band. Once you have worked some of the big guns, search more carefully up towards the higher end of the band (or in the Advanced class phone band during domestic contests) for weaker (and often slower) CQs. Constantly sweep and re-sweep across the band, as new stations will appear (and disappear) at a surprising rate.

When your search unearths a juicy new station to work, several "pounce" considerations must be examined critically. First, how heavy is your competition? If many stations are calling, or if a number of bigger stations are calling, try only 1-3 calls and move on—unless the new station is a multiplier (see the next section for a discussion of multipliers). Under most conditions, your rate will tend to drop drastically if you sit on any one station's frequency for more than a couple of minutes. A superior alternative is to try your luck elsewhere and then come back later to check if the competition has lessened and/or propagation into that area has improved for you.

Second, exactly what is the new station working? If local stations with signal strengths comparable to your own are getting answered, the chances are very good that you can get through, too. If only stations considerably louder than yours are being worked or if the stations being worked are mostly located in other geographical regions, your chances are not so hot. With experience, you will develop a feel for the probability of contacting a given station under a certain set of band and competition conditions.

Third, as was mentioned earlier, the faster, smoother operator will usually work you sooner than a poorer operator if the size of their respective pileups is about the same.

When actually answering a contest CQ, keep it short. The preferred method is to send: "de K6PU." Then send his call as part of your exchange if and when you actually do work him. If this technique causes confusion, send both his call and your call, possibly repeating your call once.

With light competition on CW, or in most instances when operating phone (the exception is split-frequency operation with a DX station), zero-beat the desired station as you would in any regular QSO. With heavy competition, more

finesse is required to break through. Time your call for a lull in average signal strength on the frequency, or try shifting slightly to either side of the desired station's frequency if operating CW.

Finally, there will be times when both calling CQ and high-rate searching-and-pouncing will no longer work. You then have three choices: change bands, take a break, or search-and-pounce at a low rate. Band changes and rest pauses will be covered in succeeding sections. Low-rate search-and-pounce requires much patience and the conviction that each new contact is worthwhile because it improves your score. The "doldrums" are among those challenges of contesting which separate the good contester from the also-ran, so hang in there—and pray for better conditions soon!

Multipliers

Scoring in a few contests is based entirely on total contacts. Field Day is a good example of this type of contest, though it does contain certain bonus factors for portable stations which we will ignore for the moment. However, most contests complicate the scoring procedure—and thereby alter contest strategy significantly—by throwing in a multiplying factor. The "multiplier" is usually the sum of the number of distinct geographical areas contacted (with the definition of what is a "distinct geographical area" varying from contest to contest).

Some examples will probably illustrate the multiplier concept most readily. In the Sweepstakes Contest, the multiplier is the sum of ARRL sections contacted. If you work a station in each of the 74 sections, your score will be:
SS Score = Total Number of QSOs × 2 × 74 sections.

In the CQ Worldwide DX Contest, the multiplier is the sum of the countries and zones worked on every band. For example:
CQ WW Multiplier = 20 countries plus 10 zones on 40 meters and 50 countries and 20 zones on 20 meters = (20 + 10)+(50 + 20)= 100 (if one operated only on 20 and 40 meters in that particular contest).

In the California QSO Party, the multiplier for non-California stations is the number of California counties worked.

So much for what a multiplier is—now let's take a look at what effects a multiplying factor has on contest strategy. In a typical contest, your contact total will be significantly larger than your multiplier factor. Thus, each additional multiplier contact is worth a lot more than each additional non-multiplier contact—often five times as much, sometimes ten times as much, and possibly twenty times as much! However, finding an additional multiplier to work, or breaking through a pileup of twenty other stations who also need him for a multiplier, may take even more time than contacting an additional five or ten "ordinary" stations. Herein lies another major challenge of contesting: to balance contact rate and multiplier total in such a way as to maximize your score.

There is no simple answer to this dilemma. The best compromise depends upon a host of factors: the contest in which you are operating, your signal strength, your operating ability (especially your ability to search-and-pounce rapidly), band conditions, your geographical location, etc. Multipliers are generally easier to come by naturally in the course of making contacts in domestic, as opposed to DX, contests. In Sweepstakes, for example, the first fifty to sixty multipliers are almost automatic for the active participant, while the remainder of the seventy-four possible multipliers become progressively tougher to accumulate.

Experience in any given contest will teach you which multipliers are relatively rare; if you hear one of these, spend a little more time trying to work him than you would on a normal contact. Beware, though, of sitting on a rare multiplier's frequency for long periods of time. Unless contacts are really coming slowly, call a multiplier several times, note his frequency if you miss him, and try again every five to ten minutes. As his pileup (and rare multipliers usually do have pileups!) dies down, and as band conditions improve, your chances of working him become better. On the other hand, if band conditions become poorer, you may never get another chance to work him.

It is difficult, at the basic level, to provide any further solid tips on multipliers which will hold for all or even most contests. This is something one really needs to develop a feel for through experience.

Changing Bands

It is clear by now that there are two major goals in most contests: making a high contact rate and collecting multipliers. Simply stated, you should change bands only when by doing so you will improve your rate and/or add some new multipliers to your total.

In contests where you may work a station once on each different band (CQ Worldwide, ARRL DX, Field Day, etc.), the best general strategy is to operate on the highest band that is open. If the opening is not a particularly good one, your rate will suffer. In that case, it may be best to grab what multipliers you can quickly and then QSY to the next band down (for example, from fifteen to twenty).

Sweepstakes is a good example of a contest in which you may contact each station only once, regardless of band. In such contests you should strive to be on the band which will produce the highest rate, and pay less attention to marginal openings on the higher bands. However, a good high-band (15 and 10) opening can really boost a score (especially a little gun's, as noted earlier), so it is important to monitor other bands for possible openings. This involves interrupting your operating whenever your rate slows, switching your receiver to any other bands which might be open, and quickly turning across the band.

If a given band appears to be active, listen more carefully to see if the activity level there is higher than that of the band on which you have been operating—and/or check for multipliers you still need. Choose the band likely to be the most productive for you in terms of contacts or multipliers, and either stay put or QSY. The importance of monitoring other bands is even greater when you may work the same station on each band, so by all means do it and your score will almost surely improve.

A cost of such monitoring is the time lost in adjusting your receiver to listen on each different band plus the time required to tune around the band. The technique of tuning around the band rapidly has already been discussed. Receiver adjustment—or the even more time-consuming task of tweaking both transmitter and receiver—is something which can be speeded up tremendously through practice and one simple trick.

Place some white stick-on labels (masking tape will

also work OK) on your transmitter, receiver, amplifier, etc., panels just above all controls which must be adjusted when a band change is made. Pick out a band—eighty meters, for example—and tune up. Directly opposite the pointer line or dot on each tuning knob, make a mark on the label or tape and write "80" next to it. Do the same thing for every other band you will use in the upcoming contest. Now all you have to do to change bands is turn the bandswitch and rotate each control knob until it lines up with the appropriate marker. Very few controls are so touchy that if you are off by a fraction, performance will degrade sharply; if one or two are particularly touchy, spend an extra second or two to tweak them up after the basic changes have been made. There is seldom anything to be gained by being perfectly tuned in a contest; a few Watts more or less are unlikely to make much difference. The time you save by using this technique often does make a difference, though, as band changing now can be accomplished in ten seconds or less!

A final basic consideration when changing bands is your antenna system. If some of your antennas perform better than others, a sensible strategy is to spend more time using those antennas! For example, with a collection of dipoles and a four-element 20-meter beam, you probably would do better to spend much more time on the beam than you would on the one of the dipoles. However, this may not always be the best strategy. To continue with the beam-plus-dipoles example, it is highly likely that if your station happens to be located in the Northeast and you are operating in the Sweepstakes Contest, the 80-meter dipole would be your "best" antenna. Thus it is critical to determine through actual on-the-air tests which of your antennas performs best in which directions and in which types of contests (local, domestic, DX, etc.). In other words, know your station.

Rest Periods

As was the case with changing bands, the basic underlying philosophy in determining when to take a break is quite simple: Rest when your rate will be low and when you will be unlikely to collect many multipliers. Unfortunately, as was also the case with changing bands, deciding more concretely at which specific time periods such conditions will hold is not so easy. The question of when to rest is further complicated by your own physical endurance limitations, which will often supersede rate and multiplier considerations.

Propagation is a key factor is determining when to rest. When one or more bands are open to an area where other contest participants are available to be worked, it is usually best to be on the air—especially if the areas concerned are highly-populated ones. Propagation is such a complex function of type of contest, geographical locations, time of day, year, sunspot cycle, etc., that few generalizations can be made about it which will hold more-or-less true for all US contesters. However, one generalization is that propagation peaks occur at sunrise and sunset, while midday is a low point. This is particularly true in DX contests, so the middle of the day is a time when many top contesters take a several hour nap (if they need it) in a DX contest.

Most DX contests do not have required rest pauses; you may operate the entire forty-eight hours (or whatever) if you have the stamina. If you do not and require more than a nap in the middle of each day, the next best approach is to take a short break when your efficiency drops off and operating is pretty much a waste of time anyway (e.g., in the wee hours of the morning). Since the excitement of a good opening will tend to wake you up, while low levels of activity will usually have the opposite effect, this is not too bad a system for most operators. Of course, if you know from experience (or from conversations with knowledgeable locals) when to expect good openings to various parts of the world, you will do even better if you take your breaks between predicted openings.

The rest-pause strategy for domestic contests is a bit different than for DX contests. Here, everyone's day and night very nearly coincide, and the contests are generally shorter (20-30 hours). The best time to take a nap in a domestic contest is during the wee hours of the morning. A common strategy is to operate on forty and eighty until the rate drops off noticeably, then sack out until dawn. If rest pauses are required—you must, for example, operate no more than twenty-four hours out of thirty in Sweepstakes—the additional breaks are best taken in short bursts of fifteen to twenty minutes any time the rate drops off.

In any contest, if at all possible, it is not wise to take long breaks. As propagation prediction is not an exact science, the successful contester must constantly monitor any band which might be open. Most people have difficulty doing this while they are asleep!■

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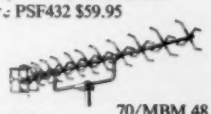

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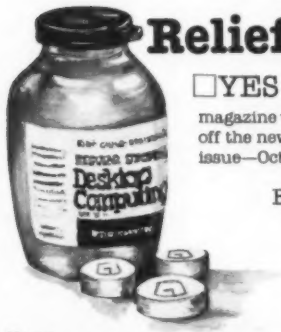

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The $50 Sweeper

— build this audio function generator and sweep your troubles away

One of my favorite aspects of ham radio is audio circuitry, and I am constantly constructing amplifiers, filters, and other devices which operate within the audio spectrum. In order to evaluate my projects, I built the swept function generator described here to use in conjunction with my oscilloscope.

The generator features a frequency range of .05 Hz to 300 kHz, digital frequency display, and a sweep range of 1000:1 or better. The unit produces sine, triangle, and square waves as well as left- or right-sloped ramps and pulses with an adjustable duty cycle of 1% to 99%. The outputs may be amplitude- or frequency-modulated by an external signal and adjusted in amplitude from six volts peak-to-peak down to millivolts. The sine, triangle, and square waves may be swept in frequency by a built-in linear sweep circuit or by an external signal. The cost is in the $50.00 range if you have a moderately stocked junk box. The majority of the parts are stocked by Radio Shack. About half of the cost is in the digital frequency display, which may be easily replaced with a frequency counter or an analog scale.

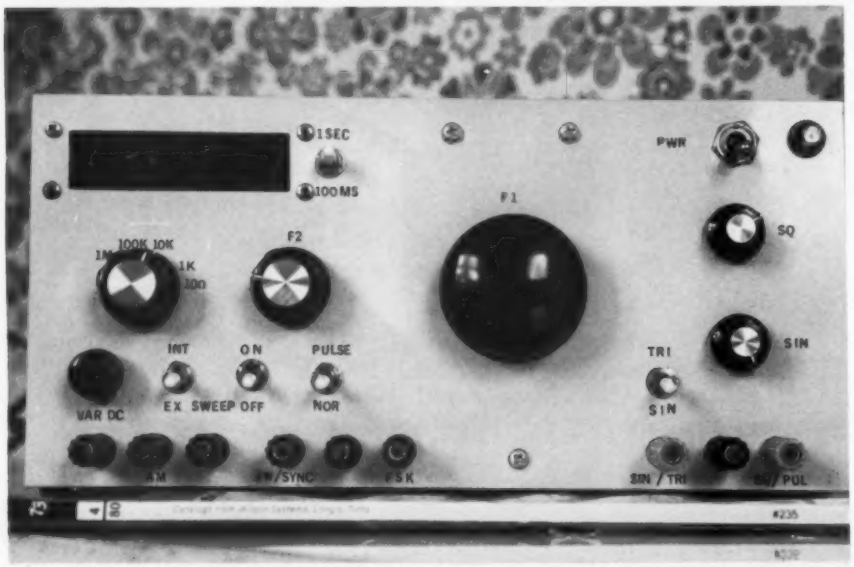

Photo A. The completed swept function generator. The knob labeled F1 is the primary frequency control and is mounted on a 3:1 gear drive. The SIN/TRI output jack also provides a ramp function. All unlabeled jacks are grounds, except the jack, far left, which is the variable dc output.

The entire unit consists of the function generator circuits, the sweep circuits, the digital display circuits, and the power supply. The function generator circuits actually contain two function generators, designated the primary and secondary, and labeled F1 and F2 in the picture of the front panel (Photo A). The two generators may be set independently of each other and it is possible to shift between the two merely by changing the logic level at the FSK jack. The amplitude of the

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MFJ-1200 GENERAL PURPOSE
CW Computer Interface

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Allows your rig to "talk CW" to your computer and vice versa.

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The MFJ-1200 CW Computer Interface processes (noise limits, filters, detects, post filters, shapes, level shifts) the received CW audio from your transceiver to provide a clean computer compatible TTL or RS-232 level.

It also takes the keyboard generated CW (TTL or RS-232 output levels) from your computer and drives high voltage keying circuits to key your tube or solid state transmitter (-300 V, 10 mA max; + 300 V, 100 mA max).

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output is absolutely constant from the lowest frequency up to 300 kHz with a usable signal generated up to about 1 MHz. Distortion of the sine wave is adjustable and quite good at approximately .5% THD.

Construction

The heart of the function generator is an XR 2206 IC. I purchased my chip from Jameco Electronics, 1021 Howard Ave., San Carlos CA 94070. Be sure to ask for the spec sheet; the additional 25 cents is well worth the price. I used the manufacturer's recommendations on wiring the 2206 except for several modifications that are peculiar to my function generator. If you do not want to build the sweep circuit, then just leave those components off of the circuit board; there are no components that are used for both the function generator and the sweep circuits.

I used ¼-Watt, 5% resistors except for R12, which is not critical but should be at least 1 Watt. Capacitors C1 through C5 are frequency-determining components and should be 5% or better, and for best results should be made of some stable material such as polystyrene. Other types of capacitors could be substituted, but the generator will be slightly less stable. Wherever possible, I have tried to provide large pads on the circuit board to accommodate capacitors of different sizes.

Trimmer pots R1, R2, R3, R6, R7, and R8 all are mounted on the PC board. I have provided space on the circuit board so that either the stand-up or the lay-down type of trimmer may be used. It seems that I always have the wrong type when building a project on someone else's circuit board, so I have allowed for both types (prospective authors please take note). Front-panel pots R4 and R5 are the other frequency-determining components. During normal use, R4 is the main frequency control, and I have mounted mine using a 3:1 gear drive so that the frequency can be varied in small increments. Potentiometer R5 is used to set the frequency of the secondary function generator and to adjust the shape of the pulse and ramp functions. I found it sufficient to mount R5 directly on the front panel without a gear drive.

The function generator may be swept in frequency by applying a varying voltage to R5. For maximum frequency sweep, 1000:1 or better, this voltage should vary from 0 V to +3 V, with the highest frequency being generated at 0 V. I have arranged the front-panel

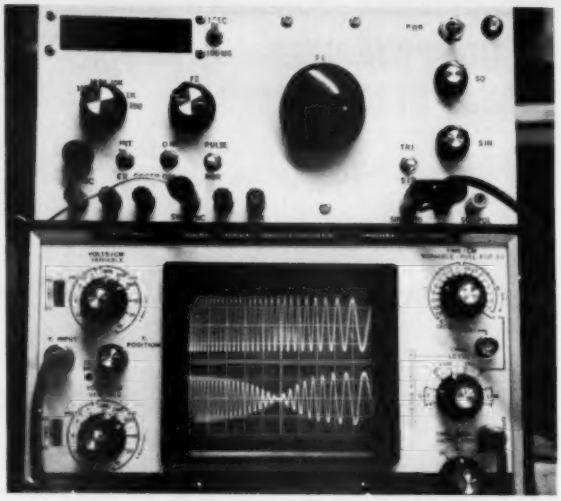

Photo B. The swept function generator in operation. The top trace is the output of the generator in the sweep mode. The bottom trace is the same signal after processing in a home-brew notch filter. The notch filter has a design frequency of 1100 Hz. Note the digital display showing 1,093 Hz which will correspond to the center of the scope face. The actual sweep here is about 20 Hz to 2200 Hz.

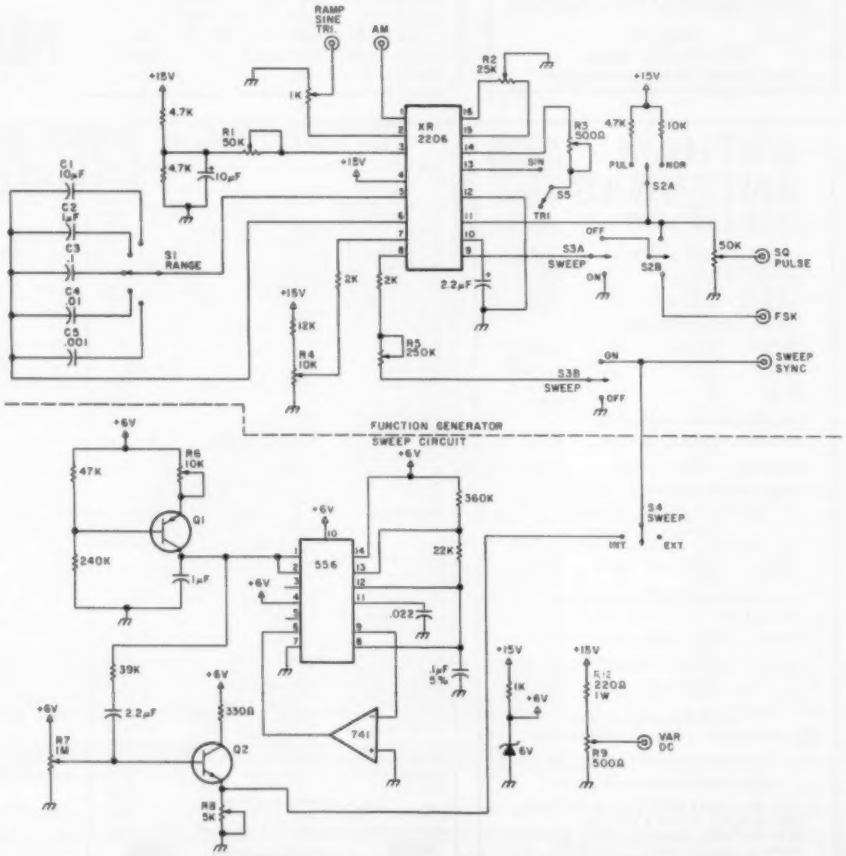

Fig. 1. Schematic of function generator and sweep generator.

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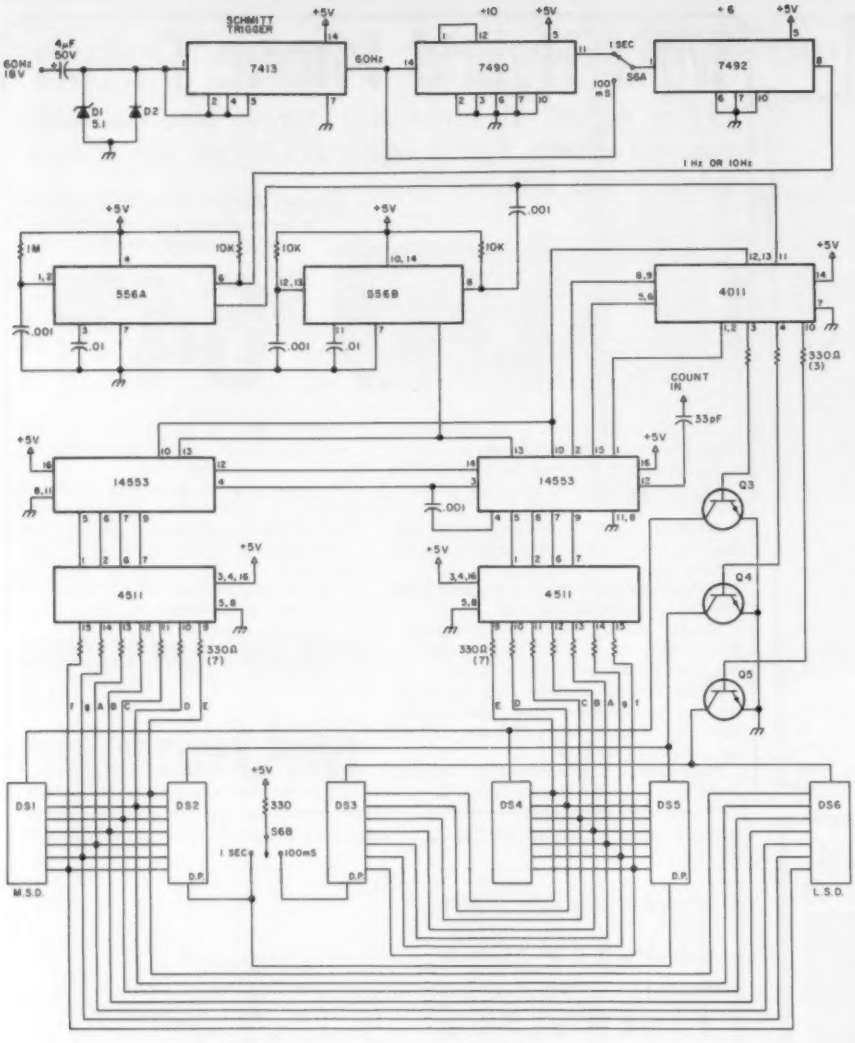

Fig. 2. Schematic of digital frequency display.

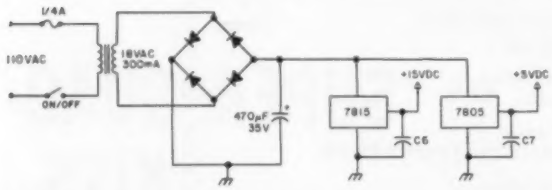

Fig. 3. Power supply. C6 and C7 are 2.2-uF tantalum and are mounted on the circuit board. All other components are mounted on the chassis.

switches so that the function generator may be swept or frequency-modulated by applying a varying voltage to the sweep/sync jack from an external source or from internal circuitry. The internal sweep circuit is a linear ramp generator which provides a 3-V ramp at a frequency which allows one sweep to fill my scope screen when set to 2 ms/cm. When the internal sweep circuit is used, the ramp signal is applied to the sweep/sync jack so that it may be used to trigger your scope.

Operation of the sweep circuit is not overly complex. One half of the 556 dual timer is wired as a monostable multivibrator which is used for a timebase. The 741 op amp inverts the output of the multivibrator to provide a good trigger signal. The actual ramp is generated by the other half of the 556 and the two transistors. Transistor Q1 is a 2N4250 or similar and provides a constant current source to capacitor C6. This constant current allows C6 to charge linearly. The other half of the 556 timer acts as a switch which grounds the positive side of C6, when triggered by the op amp. The voltage across C6 almost instantly goes to zero and then begins to recharge. Transistor Q2 (a 2N2222) is a buffer amplifier. By adjusting the dc bias on this transistor, the amplitude and position of the ramp relative to ground may be precisely set. The output of this emitter-follower type circuit is the final sweep signal.

The digital frequency display is a multiplexed unit and is based on the Radio Shack three-digit BCD counter IC, part 276-2489. The entire display was point-to-point wired on a multipurpose 22-pin edge connector circuit board which will just accommodate the 9 ICs and three 2N2222 transistors. The timebase is derived from the 60-cycle line. I have found the accuracy to be quite good at audio frequencies, often showing the same frequency as my lab grade counter, up through 50 kHz or so. Even at much higher frequencies, the difference is usually under 100 Hz and the error will always be on the low side. The frequency generated by the function generator is sampled at pin 11 of the XR 2206 and is coupled to the digital display through a 33 pF capacitor. This signal is then counted and displayed by the two sets of 14553 counter and 4511 driver ICs.

The wiring of the LED displays is a little unusual and requires an explanation. If the counter is placed in the 100-ms timebase position, it will count and display 1/10 of the actual frequency being generated, so that 4552 Hz would appear as 455. I found this to be distracting, so I added another LED display in the "ones" position and set it to display a

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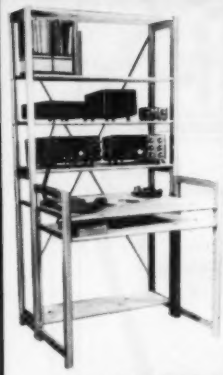

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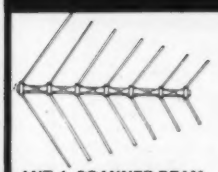

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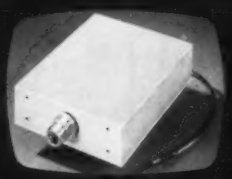

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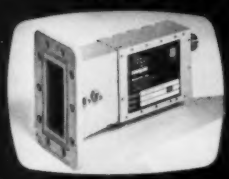

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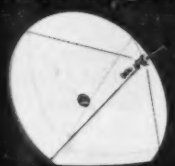

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"0". Now the frequency display would appear as 4550. In order to get the newly-added display to have the same brightness as the other digits, I wired it as if it were in the "millionth" position. There is no leading-zero blanking, so the new digit will always show a zero unless a frequency of one MHz or higher is counted. In the one-second timebase mode, this newly-added digit will appear in the "tenths" position and will be zero unless a frequency of 100 kHz or higher is counted. In this timebase, the display would appear as 4,552.0. The decimal points are wired to the timebase switch so they will always correctly separate the hundredths and thousandths digits.

The digital display circuit is set up for common-cathode displays with right-hand decimal points. Maximum current should be limited to about 25 mA per segment. I used Radio Shack 276-1644 displays but would recommend some of the multiple-digit, multiplexed units such as those sold by Digi-Key, Inc.

The timebase and control circuits for the display are fairly straightforward. A 60-cycle signal is taken off the low voltage side of the power transformer. Diode D2 and zener D1 limit the voltage excursions to −0.7 V and ±5.1 V. This 60-cycle signal is applied to a Schmitt trigger to produce an accurate square wave, and then passes through the 7492 IC wired to divide by six. The resulting 10-Hz square wave triggers the two one-shot multivibrators which form the latch and counter reset pulses. In the one-second timebase, the 60-Hz signal is divided by ten in the 7490 IC before going through the 7492, so that a 1-Hz square wave is applied to the one-shots. Again, this is a surprisingly accurate system, and I have been very pleased with the results.

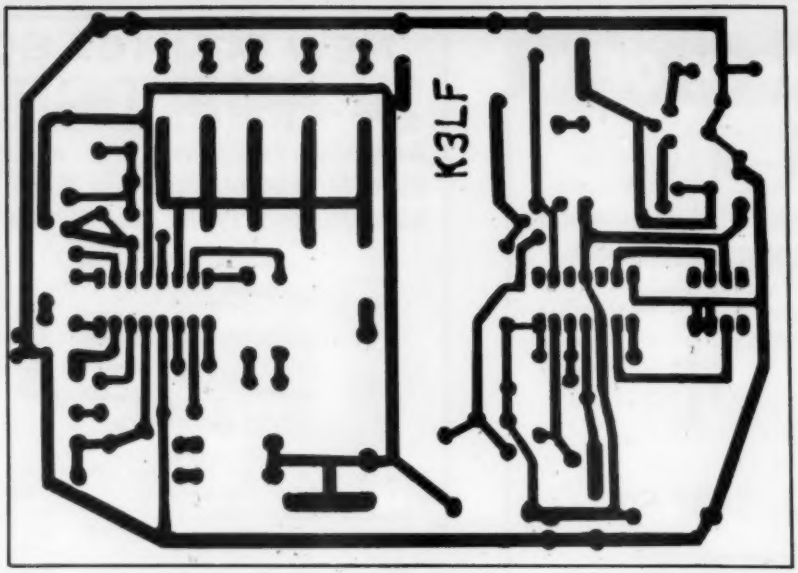

Fig. 4. PC board layout.

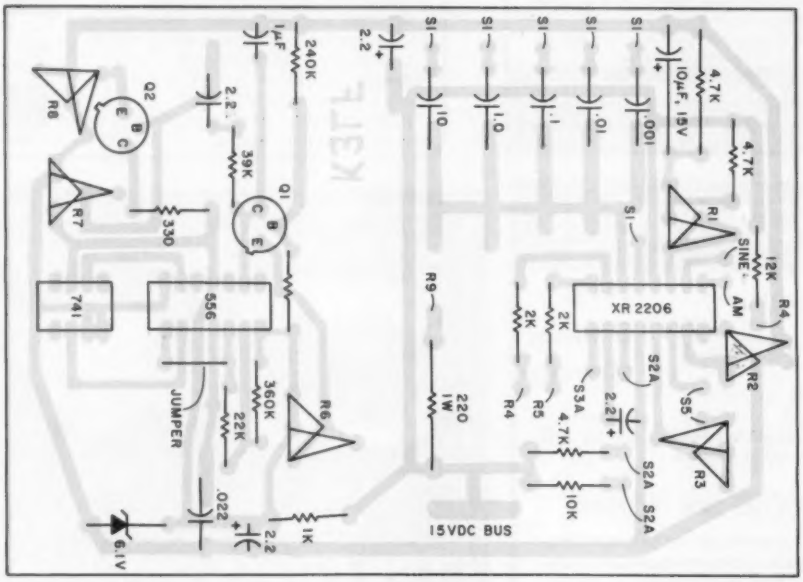

Fig. 5. PC board component location.

The power supply is fairly conventional, using an 18- or 24-V ac transformer, a bridge rectifier, and two regulators, a 15-volt and a 5-volt. If you use a 24-V ac transformer, be sure you do not exceed the maximum voltage which may be applied to the regulators; mine were rated for 35 V dc. All of the power supply components were mounted on the chassis. Note that a 2-wire power cord is used so that the chassis ground is floating and is not connected to the house wiring ground. This allows the function generator ground to be floating and set in relation to other pieces of test gear.

Calibration and Operation

Calibration is not difficult, but does require a dc-coupled oscilloscope. The function generator circuit has three adjustments. Trimmer R1 adjusts the amplitude of the signal with a maximum of six volts for

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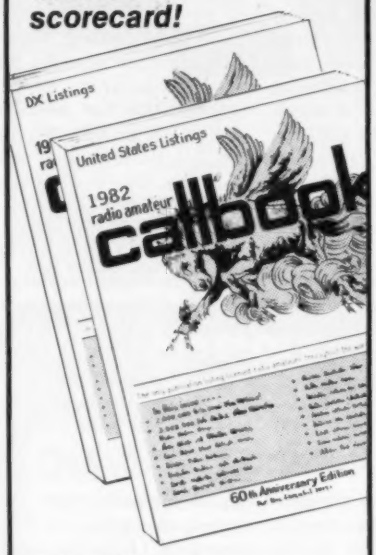

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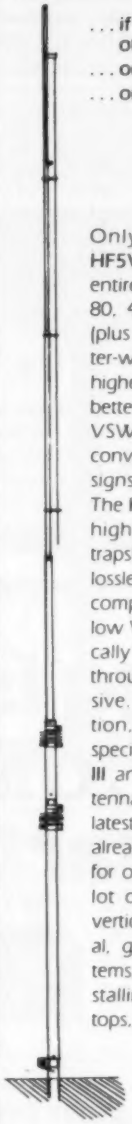

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the triangle waveform. Symmetry is adjusted by R2, and R3 adjusts distortion of the sine wave and may be replaced with a 200-Ohm resistor with fairly good results. The three adjustments will interact to some degree; the object is to maximize amplitude and minimize distortion. The sweep circuit is adjusted using R6, R7, and R8. The collector of Q1 should be monitored while adjusting R6, which should be set to a position giving the longest ramp. Too little resistance here will make the ramp generator operate at twice the trigger frequency. With an oscilloscope connected to the output of the sweep circuit, adjust R7 so that the ramp just touches the 0-volt baseline. The amplitude of the ramp is adjusted by R8 to a value of three volts p-p. There is some interaction between R7 and R8, and these adjustments are somewhat critical—so be patient.

Operation of the swept function generator should be fairly obvious, but here are some helpful hints. When operating in the sweep mode, S3 should be placed in the ON position and S4 placed in INT. This will apply the ramp signal from the sweep circuit to the function generator and to the sweep/sync output jack for synchronizing or triggering your oscilloscope. You will find the signal appears to sweep from right to left as the lower frequencies are to the right. If S4 is placed in the EXT position, then an external device may be used to sweep or frequency-modulate the function generator. Whenever S3 is ON, the average frequency will be controlled by R5 and the range switch.

To determine the range of frequencies actually being swept, place the digital frequency display in the one-second timebase mode. The displayed frequency will be very close to half of the peak frequency and 500 times the lowest frequency. I have found this to be a very handy phenomenon. If I am looking at the response of a notch filter and want to know at what frequency the notch occurs, I can adjust R5 until the notch is at the center of my scope. At that point, the frequency displayed on the digital readout will be the frequency of the notch. If I want to apply a swept signal of 10 Hz to 10,000 Hz to some piece of equipment, then I merely adjust R5 until the display shows 5,000 Hz and I will be right on target.

When operating the generator with the sweep turned off and S2 in the NOR (normal) position, the secondary function generator may be activated by grounding the FSK jack. The frequency of the secondary generator is controlled by R5 (the primary generator is controlled by R4).

One last item: Any amplitude-modulating signal must have the same dc bias as the output. Potentiometer R9 has been included to provide an adjustable dc reference voltage. The 220-Ohm resistor, R12, limits the current if the VAR dc jack is grounded.

I have had my function generator in use for about a year and have been very happy with its performance. In the future, I hope to build an interface device so that the function generator can be controlled by my KIM-1 micro via the sweep and FSK inputs. This would probably open the door to all sorts of neat applications. I hope you enjoy this versatile instrument as much as I have.■

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OMNI Accessories:

280	18A power supply *(Reg. $169)*.....	SALE	$152.95
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285	500 Hz 6 pole CW filter.....		45.00
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1140	DC circuit breaker.....		10.00

TEN-TEC Model 515 ARGONAUT All solid-state, 5 watt (QRPp) SSB/CW HF Transceiver. 5 HF bands, 80-10m plus 10 & 15 MHz WWV. No tune, broadbanded final - instant band change. Analog dial, 4-pole 2.4 KHz crystal SSB filter. Typical receiver sensitivity 0.35 uV for 10 db S + N/N ratio. Built-in SWR/S meter. QSK instant CW break-in and PTT on SSB.. ± 4 KHz offset tuning, adjustable sidetone, built-in speaker, Hi-Z mic input, LED output and offset indicator. 12-14 VDC @ 1A. 4½" × 13"w × 7½"d, 6 lbs.

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212	29-29.5 MHz crystal	5.00
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TEN-TEC Model 525 ARGOSY All solid-state, 10/100 watt SSB/CW HF Transceiver. 6 HF bands 80-10m, including the new 30m band & 10 MHz WWV; 40 kHz VFO overrun on each band edge. Switchable, 10 watts or 100 watts input. 100% duty cycle, 20 minutes. Instant band change, broadbanded, no receiver front end or final tuning. Analog dial accurate to ± 2 kHz. 4-pole 2.5 KHz crystal SSB filter, sensitivity 0.3 uV for 10 db S + N/N ratio. Meter shows forward/reverse power, SWR and received signal strength. Offset tuning ± 3 KHz, notch filter, QSK instant CW break-in and PTT on SSB, sidetone, adjustable ALC. 12-14 VDC @ 9A. 4"h × 9½"w × 12"d, 8 lbs.

Regular $549 - ***Sale Price $499.95***

ARGOSY Accessories:

225	9A power supply *(Regular $129)*....	SALE	$119.95
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New Horizons for the HW-8 Transceiver

—a dandy mod to expand frequency coverage

Roger C. Amundsen W1PQ
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Would you like to increase the tuning range of your Heathkit HW-8 to add 3750 to 4000 kHz, 7250 to 7500 kHz, 14250 to 14500 kHz, and 21250 to 21500 kHz? I did and I found it very easy to do. I wanted to listen to some of my friends on 75 and 40 and also be able to receive CHU just above 7300 kHz.

To make this modification, only two parts are required: a capacitor to pad the vfo tuning and a toggle switch to add it or leave it out of the circuit. I used a trimmer, but if you are not too fussy, a fixed capacitor of 12 pF will do.

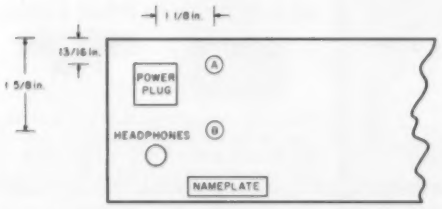

Fig. 1. HW-8 rear panel. A = 3/16" hole for 15-pF trimmer if used. B = 1/4" hole for miniature SPST toggle switch.

I located a miniature toggle switch on the rear panel (as shown in the sketch) so that no injuries were inflicted on the front panel. One side of my trimmer (mounted above the toggle switch) is grounded, so it was simple to run the other lead to one side of the toggle and then tie the other terminal of the switch via a piece of tinned bus wire to the lug on the vfo tuning capacitor, C302B.

One adjustment and you are in business. With the new capacitor switched out of the circuit, open up (reduce) the mica trimmer (C362A) on the vfo tuning capacitor to offset the stray capacity of the added circuitry. Adjust the vfo to 3500 kHz when the dial reads 0 (3.5 MHz band position). If in doubt, adjust it so that W1AW broadcasts are on 3580 kHz. No adjustments are required for the other bands. Throw the toggle switch and adjust the new trimmer for 3750 kHz for 0. The dial will now read 250 kHz higher on all bands or tune from about 3750 kHz to 4000 kHz on 80 meters. *Do not operate the transmitter function outside of authorized bands.*

Results: The HW-8 is no superhet, but for a direct-conversion receiver it is not bad. Also, if you desire to remove the mod, a couple of small hole plugs cover up the surgery. See you on 3540 kHz. ■

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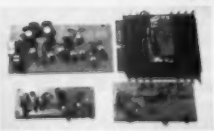

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New Frequencies for the IC-2

— for MARS members only

MARS members will be happy to know that the no-compromise, synthesized, Icom IC-2 handie-talkie can be modified easily to transceive out of band. And, best of all, the cost of this modification is a total of *zero!*

Tuning this HT is done by setting three miniature thumbwheel switches — one each for MHz, 100 kHz, and 10 kHz. A slide switch beside the thumbwheels adds 5 kHz to the frequency. Although the MHz thumbwheel turns throughout its full 0-9 range, the synthesizer confines the actual frequency to the amateur band, as shown in Table 1.

After inspection of the circuit boards, thumbwheel switches, and schematic, it became apparent that this HT was manufactured for usage throughout the range of 140.000-149.995 MHz. By the placement of jumpers, it can be configured to the different band plans for Europe, England, and the USA.

After making this modification, the IC-2 will tune from 140.000 through 149.995 MHz in 5-kHz steps following the exact thumbwheel setting. All other functions remain the same.

Step 1. Remove the battery pack. Remove the four screws that hold the battery retaining plate on the bottom. (Note the position of the plate to assist in reassembly.)

Step 2. Turn the HT face down. Remove the two case retaining screws.

Warning: A paper-thin, flexible, printed circuit board connects between the touchtone™ pad and chassis on the IC-2AT model. Be extremely careful if you remove the front half of the HT case.

Step 3. Remove the back half of the HT case.

Step 4. Using the picture of the HT on page 20 of the Icom manual and Fig. 1, here, find the programmable divider chip, IC1, and the flexible circuit-board tape soldered to it. Run solder across the non-conductive gap in the line designated C4. Use a small, low-wattage iron so as not to damage the flexible circuit board.

Step 5. Remove the two retaining screws on the side of the chassis and hinge open the two circuit boards.

Step 6. Find the brown-colored jumper wire that connects two solder pads together on the underside of the MHz thumbwheel switch. Snip this jumper and tape the ends.

Step 7. Carefully reassemble the HT. Make changes in the Icom manual and on the schematic.

Navy-Marine Corps MARS in Tennessee is currently using a 600-kHz split in the 148-MHz range. If you require a non-standard split, the MARS modification article for the Tempo S1, written by Dorsey "Diz" Price K5EDS in the April, 1980, issue of *73* should be reviewed. A similar modification could be made to the IC-2. I'll let someone else write that one! ■

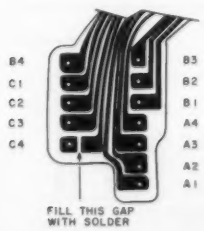

Fig. 1.

MHz Thumbwheel	Actual Frequency
0	144.XXX
1	145
2	146
3	147
4	144
5	145
6	146
7	147
8	144
9	145

Table 1.

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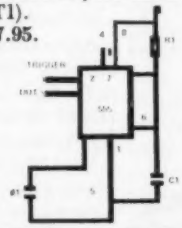

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The Digital Defender

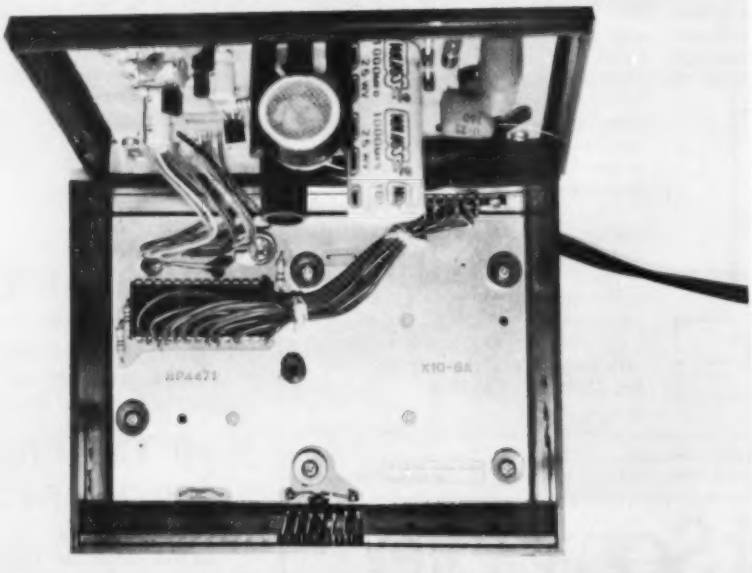
— computerized ham shack security

Protecting personal property, be it ham shack or home, is big business these days. Even traditional department stores have started to stock systems which blast you with bells, whistles, or horns when activated. None of those systems has the flexibility to cover several possible installation situations and provide complete protection. This system probably won't either, but it comes a lot closer.

Requirements

Requirements for this system are that it be inexpensive, flexible, easily installed, and as foolproof as possible. The sensors must be easily installed and repairable. They should sense breakage, smoke, fire, and when someone is about to enter a protected area. Warnings should be audible and visual. The system should have built-in self-test features along with power-fail battery backup. And, as a final touch, it should have the capability of controlling lights or appliances.

To fulfill these requirements is no small task and is difficult without the use of some external intelligence. By now probably you have guessed that a microcomputer might be the intelligence. Well, it is, and the total cost of this system is well below that of most of today's allband transceivers. The system described here was developed on a Heath H8 with parallel I/O, but is easily adaptable to any system or single-board micro having an 8-bit parallel I/O port and about 8K of memory.



This photo shows the internal wiring of the Sears control unit. Be sure to route wiring as close to the circuit board as possible and away from the ac power wires.

System Planning

To find out the best way to protect yourself or your property, ask a burglar. The next best way is to ask the police. Since this system is to provide for fire and smoke detection also, a stop by the fire station for a few pointers would be advisable. With these ideas in mind, on to the planning.

One of the best ways to plan and install a detection system is to draw a scale floor plan of the area to be protected. Figs. 1, 2, and 3 assume that it is a house that is to be protected. It is a good idea to show fire-/smoke-detector locations as well as alarm sensors. Divide the total area to be protected into smaller, well-defined zones, keeping in mind how sensor wires can be installed. Once one has a general idea of how the sensor installation might be done, the next step is to define system operating conditions.

The fire-/smoke-alarm section of the system should function even though the micro may have failed or is being used for other purposes. If ac power has failed, the automatic lighting will not function, but the alarm will since the system has battery backup. For safety reasons, the complete system (except for micro power) operates at +18 volts or less. All voltages are derived from the same source so that if the battery fails, no false alarm will sound. This may or may not be an advantage depending on system usage.

No system yet devised is completely foolproof. Several techniques are used in software (see Software Description) to avoid false alarms caused by spurious noise spikes, power outages, lightning strikes, and ham radio transmissions. Murphy's Law is still in effect, however.

One additional feature is a time-of-day clock. It is not listed under requirements because it applies only to the Heath H8 system. It is a software-generated clock and utilizes the H8 front panel for readout. This same function (minus the H8 front panel) is used for timing in the software (lines 200-245) to control the rest of the sequence. This clock function is derived from the internal tick counter of the computer and is described in the software section below. Along with the clock, facilities were built into the software to record when (time of day) an entry was made. An automatic self-test feature also was included.

System Design

For purposes of system description and layout, the Fig. 4 block diagram is included to help avoid confusion. The system is divided into three basic parts. Part (C) is the H8-2 Heath I/O and is shown for clarity. Parts (A) and (B) can be combined into one unit or board even though they are shown as being separate. The reason for separation is that I chose to build two units using .1 × .1 inch, 22-pin, two-sided, plug-in vectorboards. Circuit-Stik copper strip and pads are used to mount components, and wire-wrap sockets are used for the IC sockets. The two boards are connected together by a 16-pin DIP jumper (U10).

Early in the design stage, a decision was made to allow for several types of simple sensors. The simplest of these is the open/closed circuit. A decision also was made to provide all signal conditioning and detector logic outside the computer enclosure. As a result, parts (A) and (B) are external to the computer and all inputs and outputs are external to the detector enclosure.

Power Source

To overcome the power problem, a backup source of power is used. Fig. 5 is a block diagram of one method of doing this. This particular method is not as efficient as a more complex battery and regulator circuit, but it is simpler. Also shown in Fig. 5 is the method of connecting both the charger and inverter to the battery. The inverter will run about ten hours on a fully-charged 12-volt automobile battery. The charger is set for 14 volts so that as soon as line power is restored, the battery is automatically recharged. Additional filtering was added to the charger to reduce the feedthrough ripple. A device called "Mayday," manufactured by Sun Technology, Inc., New Durham NH 03855, is purported to prevent loss of memory when brownouts or blackouts occur. In any case, a 200-Watt power source will be sufficient for a fully-loaded H8.

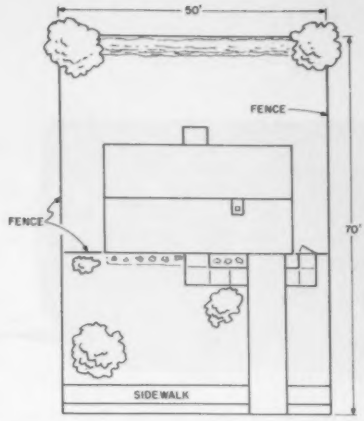


Fig. 1. Plat.

Fig. 2. Wall views.

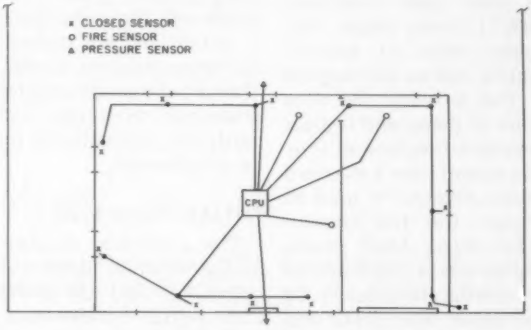


Fig. 3. Floor plan.

Sensors

All of the detector logic—part (A)—uses positive true logic, i.e., a 1, or high, level indicates a fault. Reverse logic can be used also and will be explained later. Both the burglar and/or fire alarms are designed to operate with positive or negative logic.

All sensors with the exception of the smoke alarms are made of small-gauge copper- or enamel-covered copper wire and are shown in Fig. 12. These are the least expensive and

This shows the position of the I/O connector on the Sears control unit.

easiest to install. No relays or magnets are used although they are easily substituted.

Fire detectors are manufactured from a short piece of rosin core (Multicore) .028" (.71mm) solder. This solder melts at approximately 450 to 550 degrees F. This is below the flash point of paper and is great around a fireplace or flue. The output from a standard smoke detector is used to trigger the fire-/smoke-alarm input. Most smoke alarms use a transistor to turn on the alarm device, so the sensor lines (input and ground of U8) are connected at the switching-transistor input. Some schematic checking may be required for your particular smoke alarm.

Two additional sensors are provided; these are pressure types. They are manufactured from two galvanized sheet-metal plates separated by a 4- or 6-mil plastic sheet. The plates are approximately 2 × 3 feet and are covered by indoor/outdoor carpet. The carpet is used partly for protection from rain and partly for concealment on an outside step.

Part (A)—Alarm Logic

The schematic diagram of Fig. 6 is the detection board. U1 and U8 along with signal conditioning form the inputs to the system. U1 is the burglar-alarm section and U8 is the fire-alarm section. R15 through R28 (10k) form pull-up levels for each input line. Diodes CR1 through CR12 (10-V zeners) have two functions. The main function is to limit the positive input voltage via R1 through R12 (1k) to 10 volts. In normal operation, the input lines are shorted to ground through the sensor and go high only when the sensor is tripped. The second function of the diodes is to provide a method of checking operation of the system by software. U1 and U8 are CMOS non-inverting buffers. If it is desired to have a closure to ground when a sensor is tripped, U1 and/or U8 can be changed to a 4049B inverter. The diodes must be reversed along with ground and +5 volts on RL.

U2 and U3 form an 8-bit latch which stores whatever input changed. U4 is connected in parallel with U2 and U3 and is an 8-input NOR gate. No matter which input line goes high, the output of U4 (pin 13) goes low. This line is used to tell the computer I/O that valid data is ready to be sent. Pins 5 of U2 and U3 are tied together and to the SEND DATA line of the computer. The software will toggle this line several times to be sure that the data is constant and available for the correct length of time, thus preventing static discharges from triggering the alarm. These two lines form the major handshaking with the computer.

U9 and Q1 form the self-test circuit. U9 is connected via the board interconnect, U10 to U16. The software randomly checks the system to determine if it is still functional. RL forces +5 volts on all inputs simultaneously and the computer reads the results. If the value read is not correct, a notice is printed out and the program continues. S1 is provided to allow a local check of the system. The software monitors this function and will inform the operator if all is well.

U5 and U6a form the code logic. The logic is nothing more than an eight-line-to-binary conversion. This method allows 16 input lines to use only four of the eight data-output lines to the computer. Data-output line D4 is used only to record the fact that a fire/smoke sensor was triggered and to turn on all lights. The alarm is set off without computer intervention.

U7 is used in the same manner as U4 except that its output drives the input of U6b which is used as an inverter. As in the case of U1, if an input to U8 should open, pin 13 of U6b would go high, indicating an alarm condition. Two additional lines into U7 are provided as shown in Fig. 6. They are used to connect to the smoke alarms. If they are not used, they should be grounded.

U13/U11 and U14/U12 form the pressure sensors.

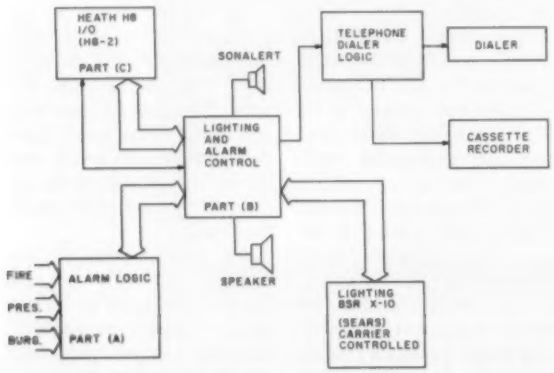


Fig. 4. Block diagram.

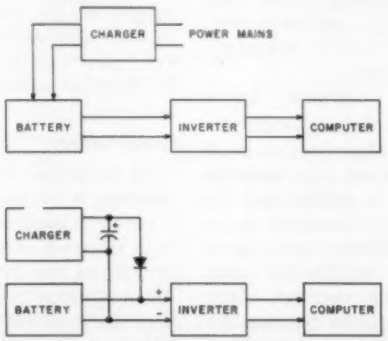


Fig. 5. Power source.

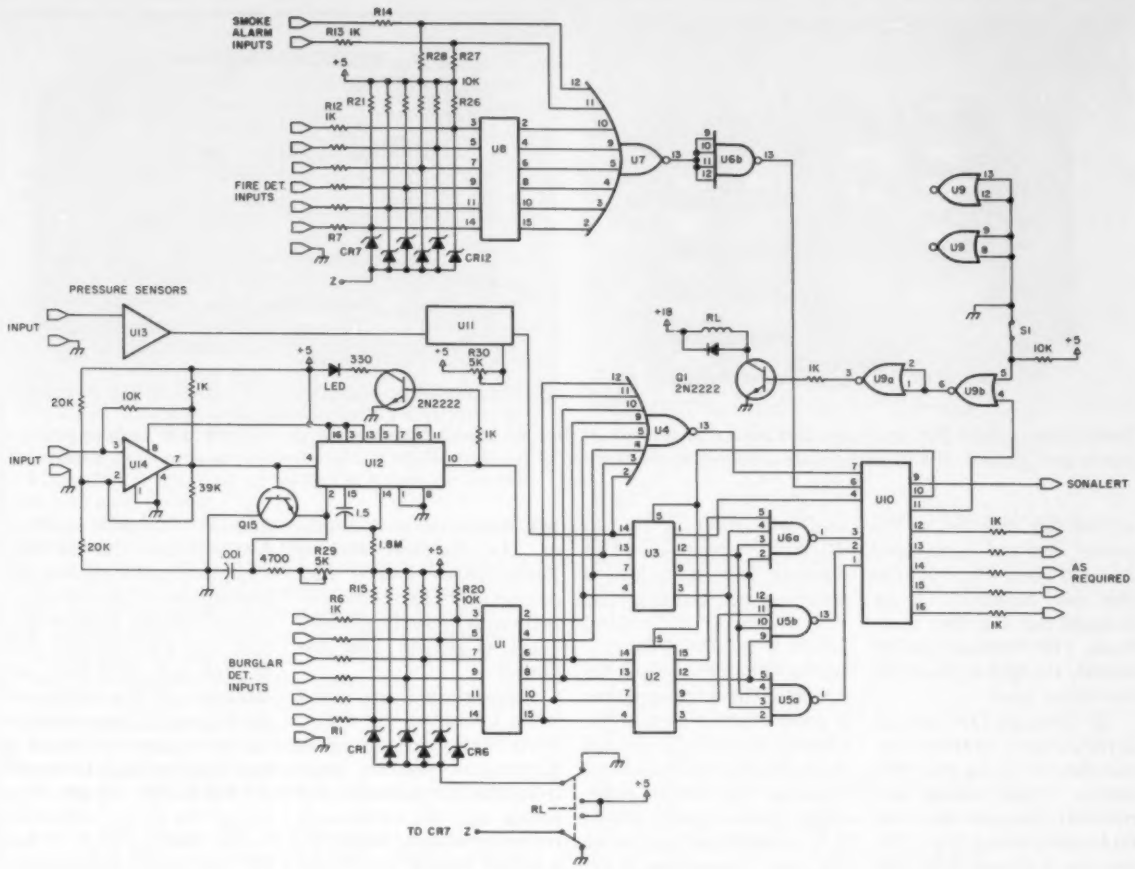


Fig. 6. Part (A), alarm logic.

Since the function of each is the same, only one set will be described. U14 is an LM311 that is connected as a multivibrator which runs at approximately 1 MHz with no input. When a fifty-foot length of Belden 8401 microphone cable and the two galvanized plates are attached, it runs at about 50 kHz. U12 is a CMOS dual one-shot. The first section along with Q15 forms a missing-pulse detector. When pressure (stepping on the plates) is applied to the plates, the frequency goes down and the one-shot times out and triggers the second section of U12. The second one-shot is retriggerable and the output goes high for approximately 3 seconds. The LED is used only for visual aid. R29 and R30 provide adjustment of the missing-pulse detector to allow for various cable lengths and plate sizes. A fixed resistor in series with R29 and R30 provides additional range if required.

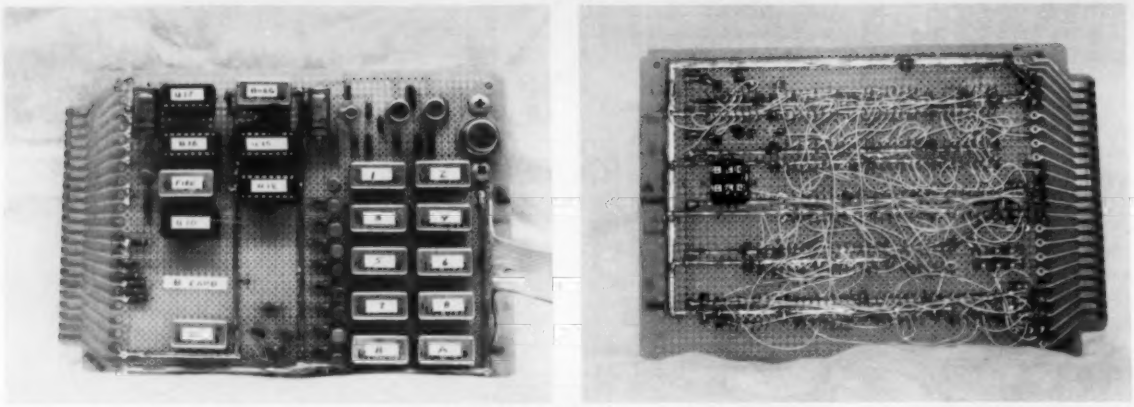
Part (B)— Lighting and Alarm Control

The Fig. 7, part (B), schematic is perhaps the heart of the system. The function of this part is to provide a path for data to and from the computer I/O. Handshaking information is passed through this card and onto the part (A) card. Incoming data from the part (A) card is passed through this card and into the computer I/O.

U15 and U16 form a 4-line-to-16-line decimal decoder. The output lines, 1 through 9, are connected directly to the inputs of nine driver transistors (Q3 through Q13) which, in turn, are connected to relays labeled 1 through 8. Line 9 is connected to the same type of transistor driver/relay (Fig. 8) as well as to the fire-alarm circuit. The line-9 relay controls the external alarm simultaneously with the internal fire-alarm circuit. This combination alerts anyone inside or outside the house. The remaining lines from U16 are returned via the U10 interconnect to the part (A) board.

U18 is a two-bit decoder which is used in combination with U15 and U16. The output of U18 is connected to three driver transistors which, in turn, are connected to relays. These relays are labeled A, B, and C. These relays, along with those labeled 1 through 8, are the control relays for the operation of one of the neatest devices to come along in a long time. This device is a BSR X-10 (Sears) carrier-controlled lighting system. This little gem will control home or office lighting or applicances with just a push of a button. It uses existing power wiring, is inexpensive, and provides an ideal solution to a complex problem. (It is beyond the scope of this article to describe the BSR X-10, but a good description of it can be found in the January, 1980, issue of *Byte*, "Computerize a Home.")

The BSR X-10 is modified slightly to allow the control lines to be brought out to the relays. Relays must be used to control the device because the control unit is



These photos show the front (left) and back (right) views of the "A" board. Note the use of "Circuit-Stik" copper strip for power and ground. The IC sockets are soldered to the copper strip to hold them in place before the wire-wrap is installed.

connected directly to the power line and is powered by −20 volts. Fig. 9 defines the pin numbers to be brought out and their functions. The method used to modify the BSR X-10 will be described later.

Q3 through Q14 are all 2N2222-type transistors, but they could be any NPN device. Power ratings are minimal because they are on for only about 35 ms. Relays are +12-volt SPST DIP types. RL must be a DPDT type as shown. Any small relay can be used.

Alarms

Not counting lighting control, this system has only two alarms. The burglar alarm is a "warble" type and will drive a 30- or 40-Watt speaker. The speaker is mounted in a weatherproof housing. The fire alarm is a Sonalert which is mounted directly on the hot air ducting of the furnace. The ducting makes a good sound pipe and the alarm is easily heard throughout a medium-sized building. Fig. 8 is the schematic of the warble alarm. It is a modified version of the one found in H.W. Sams' *Solid State Electronic Projects*, 1972, page 52.

Telephone Dialer

An output for a telephone dialer (see Fig. 4) is included for special usage. This line is connected to a small amount of logic which controls an autodialer. The dialer is sold by Radio Shack and is connected so that an audio cassette with prerecorded messages is played over the phone.

Care should be used when operating the dialer. Most states do not allow automatic dialers controlled by computers to dial police and fire services. A friend or relative would be a better choice. No circuit description is included here because of regulations that city, county, and telephone companies have instituted.

BSR X-10 Modifications

The BSR X-10 is modified by first removing a single screw in the bottom of the unit. It will come apart in two sections. The LSI chip and push-buttons are in the top section while the transmitter is in the bottom section. The push-buttons will not fall out since they are mounted on the reverse of the PC board. There is room on the top section to cut a hole large enough to install a 14-pin DIP socket. The pins of the socket are wired to the control pins of the LSI chip using small-gauge stranded wire soldered directly to the pin.

Fig. 9 defines the pins and their functions. It is necessary only to tack-solder this connection. The BSR X-10 will function manually as well as from computer control.

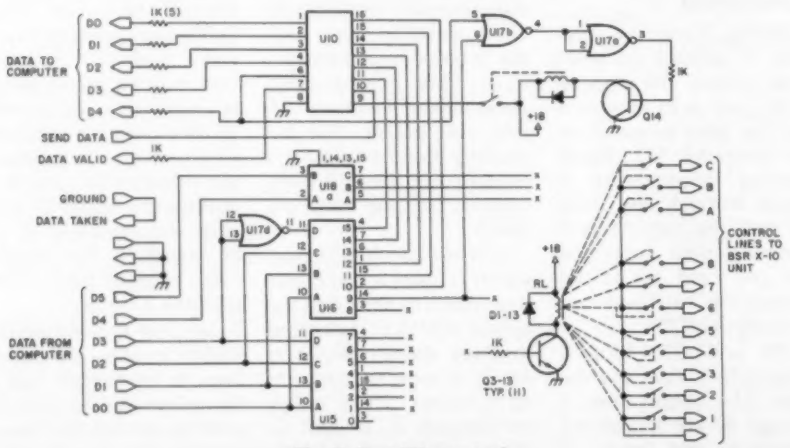


Fig. 7. Part (B), control.

Unused Outputs

Several spare outputs are provided for other devices. A word of caution when using these outputs: All are capable of driving one TTL load and it is advisable to include a 1k series resistor when using any of them for additional functions.

Software Design—Overview

The major function of the software is to generate a clock for reference and to help control all other activities of the alarm system. The clock routine is a modified version of an H8 alarm-clock program written by

SOFTWARE DESCRIPTION

- Lines 10 through 18 are reminders only. Heath Extended BASIC version 10.05 is used although this software will work on version 10.02 as well as HDOS.
- Lines 20 through 28 allow automatic title centering.
- Lines 30 through 35 are a printed warning for proper port I/O addressing.
- Lines 36 through 46 check to see if the H8-2 will respond. If not, the program stops.
- Line 48 determines the number of days alarm information can be stored. If more time is required, the dimension statement can be changed. The only limit is the amount of memory in the computer.
- Lines 50 through 62 set up and check the time of day that was input from the keyboard.
- Line 64 defines which buttons on the BSR X-10 will be used. The values 33 through 40 equate (see Figs. 9 and 11) to the following buttons: 10, 2, 6, 8, 4, 14, 12, and 16. Any value can be used here.
- Lines 70 through 74 set up the CNTRL-B function and the H8 front-panel readout.
- Lines 80 through 84 check the burglar alarm for operation. If the alarm does not respond, the program stops.
- Line 88 clears the remote-lighting control (BSR X-10) unit.
- Lines 100 through 135 are the alarm check routine.
- Lines 200 through 265 are the clock-counter routine.
- Lines 500 through 595 are the main lighting routine. Note that the lights are not turned on if the time is between the hours of 6 in the morning and 6 in the evening.
- Lines 600 through 695 control when, and the length of time, a randomly-selected light is on.
- Lines 700 through 710 are a subroutine used as a timing routine to allow the relay time to close.
- Lines 800 through 810 are the OFF lighting relay timing routine.
- Lines 1000 through 1060 print the system status when a control-B is used. Any entries are stored in memory and are printed on command.
- Lines 1100 through 1140 are the system error print routines.
- Lines 1200 through 1225 set off the alarm. Before the alarm is actually turned on, the counter (B1) must count eight alarm conditions before the alarm relay is set to ON. This is done to prevent static or power glitches from triggering the alarm. If it is after 6 pm, line 1220 turns all controlled lights on as well as the alarm. Only a control-B or power failure will shut off the alarm. An external switch will silence the speaker but the alarm is still activated.

You will note that the telephone dialer function was not included in the software listing. If it is to be used, it would be added after line 1305 in the case of fire and 1215 in the case of possible burglars. The code would be as follows:

1306 OUT 2,x:FOR L = 1 TO 30:NEXT L:OUT 2,0

where x will equal the value (decimal) required for the output port selected.

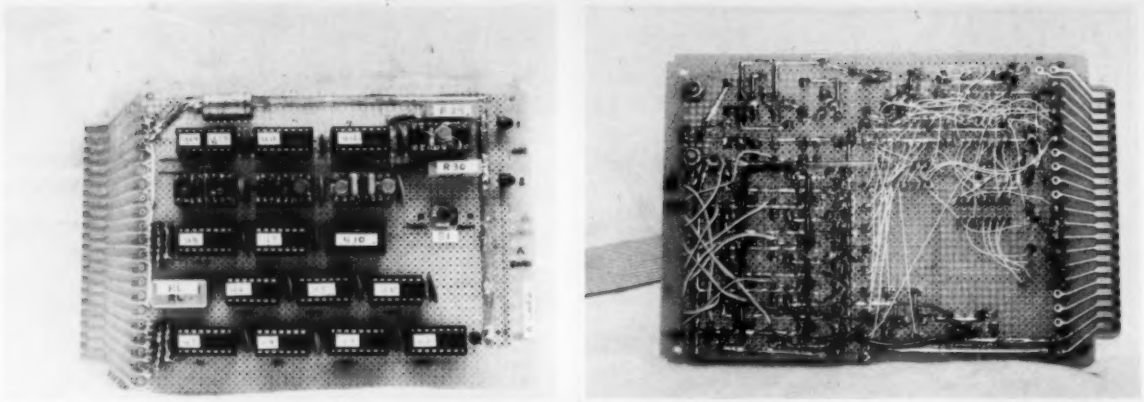
- Lines 1300 through 1310 turn all controlled lights on in case of fire. After the lights are on, the telephone dialer would then be turned on. The program would then return to the timekeeping routine line (200).

Adrian Thornton for the December, 1979, issue of *Kilobaud*. The clock time-set routine was modified for 24-hour operation and the alarm routine was modified to control the burglar/fire alarm using the H8 software control-B function. The control-B function also prints out the system status. In my case, the computer is never turned off and the terminal is always on.

Probably the best way to describe the functions of the software program is to go through it line by line

Program listing.

```
 10 REM ** BURGLAR/FIRE ALARM SYSTEM WRITTEN FOR THE HEATH H8 MICROCOMPUTER **
 12 REM ** REQUIRES APPROXIMATELY 16K OF MEMORY AND H8-2 PARALLEL I/O BOARD **
 14 REM ** WRITTEN BY LARRY T. WIER *** BELLEVUE, WA. ** 98007 *** FOR HEATH
 16 REM EXT. B.M. BASIC VER. 10.05 **
 18 REM  ** VER. 1.0.0    LATEST REVISION  JUNE 1980  **
 20 DIM Z(8),A(8):O8=
                     "+O8=O8+O8+O8+O8
 22 DEF FN K$(X$)=LEFT$(X$,35-INT(LEN(X$)/2))+X$
 24 T1$="**********************":T$="* ALARM SYSTEM *"
 26 PRINT FN K$(T1$):PRINT FN K$(T$):PRINT FN K$(T1$):PRINT
 28 T$="** WARNING **":PRINT FN K$(T$):PRINT
 30 PRINT TAB(5)"THIS ALARM SYSTEM REQUIRES ADDITIONAL HARDWARE TO FUNCTION CORR

ECTLY."
 32 PRINT "THE SOFTWARE EXPECTS PORT ADDRESSES 2 AND 3 FOR THE PARALLEL I/O.  IF

"
 34 PRINT "YOUR H8-2 IS NOT ADDRESSED HERE IT MUST BE CHANGED.  REFER TO THE H8-

2"
 35 PRINT "MANUAL FOR PROCEDURE.":PRINT
 36 REM ** PORT ADDRESS CHECK **
 38 OUT 3,64:OUT 3,78:OUT 3,53:Z=PIN(3):Z1=Z1+1
 40 IF Z<>133AND Z1>3THEN 44
 42 GOTO 48
 44 PRINT TAB(5)"THE CORRECT STATUS WAS NOT READ FROM THE I/O PORT.  PLEASE CHEC

K THE"
 46 PRINT "I/O PORT ADDRESS.  A VALUE OF";Z;" WAS READ.":STOP
 48 DIM D(24),D1(24),D2(24),D3(24),D4(24)
 50 REM * * * * SET-UP CLOCK * * * *
 52 T1$="** * 24 HOUR CLOCK SET-UP * **":PRINT FN K$(T1$):PRINT
 54 LINE INPUT "ENTER CURRENT TIME OF DAY AS 6 DIGITS: (HHMMSS)  ";T$
 56 IF LEN(T$)=6AND VAL(T$)<240000AND VAL(T$)>1000THEN 60
 58 PRINT :PRINT CHR$(7)"INVALID INPUT -- PLEASE TRY AGAIN":GOTO 54
 60 T1=VAL(LEFT$(T$,2)):T2=VAL(MID$(T$,3,2)):T3=VAL(RIGHT$(T$,2))
 62 A=0:B=250:T4=1:T2$="NO UNUSUAL":T3$="THE FOLLOWING"
 64 A(1)=33:A(2)=34:A(3)=35:A(4)=36:A(5)=37:A(6)=38:A(7)=39:A(8)=40
 70 REM ** ** ** SET UP FRONT PANEL AND CNTRL-B FUNCTION ** ** **
 72 CNTRL 2,1:CNTRL 0,1000
 74 FOR I=0TO 2:POKE 8205+I*3,255:NEXT I
 80 REM ** ** ** ALARM POWER STATUS ** ** **
 82 OUT 2,0:OUT 2,15:FOR L=1TO 30:NEXT L:C=PIN(2):C=PIN(2):OUT 2,0
 84 IF C<>23THEN PRINT TAB(7)CHR$(7)"* ** ALARM IS NOT POWERED OR AUTO TEST WAS

FAILED.  CHECK SYSTEM.  ** *":STOP
 86 REM ** ** CLEAR REMOTE DEVICES (BSR-10) ** **
 88 OUT 2,54:FOR L=1TO 30:NEXT L:OUT 2,0
 100 REM * * * * ALARM CHECK ROUTINE * * * *
 105 C=PIN(2):C=PIN(2):IF Z=1THEN 690
 110 IF C=0THEN 200
 115 IF C>=1AND C<=7THEN 1200
 120 IF C=8THEN 500
 125 IF C=16THEN 1300
 130 IF C=23THEN PRINT :PRINT TAB(10)"SYSTEM SELF CHECK OK.":GOTO 200
 135 GOSUB 1100
 200 REM ** ** LOOK AT INTERNAL CLOCK COUNTER ** **
 205 X=PEEK(8220)
 210 IF X=P THEN 500
 215 P=X:A=A+1
 220 IF A=B THEN T3=T3+3:A=0
 225 IF INT(X/2)<>X/2THEN 100
 230 T3=T3+1
 235 IF T3>59THEN T3=T3-60:T2=T2+1
 240 IF T2>59THEN T2=0:T1=T1+1
 245 IF T1=24THEN T4=T4+1:T1=0
 250 POKE 8211,SEG(T3-(INT(T3/10)*10)):POKE 8210,SEG(INT(T3/10))
 255 POKE 8208,SEG(T2-(INT(T2/10)*10)):POKE 8207,SEG(INT(T2/10))
 260 POKE 8205,SEG(T1-(INT(T1/10)*10)):POKE 8204,SEG(INT(T1/10))
 265 GOTO 100
 500 REM ** ** ** MAIN RANDOM SYSTEM AND LIGHT CHECK ROUTINE ** ** **
 505 A9=RND(1)*10:IF A9<=.001THEN 570
 510 IF T1<=17AND T1>=6THEN 200
 512 I=INT(RND(1)*9)+1:IF Z(I)=1THEN Z(I)=0:C1=A(I):GOSUB 800
 515 IF C=8THEN 600
 520 A9=RND(1)*10:IF A9>=.0015THEN 200
 525 A9=INT(RND(1)*9):GOTO 600
 570 REM ** ** SELF CHECK ROUTINE ** **
 585 OUT 2,15:FOR L=1TO 30:NEXT L:C=PIN(2):C=PIN(2):OUT 2,0
 590 IF C<>23THEN PRINT "SYSTEM AUTO CHECK FAILED.  PLEASE CHECK MANUAL OPERATIO

N.":PRINT :PRINT
 595 GOTO 200
 600 REM ** ** LIGHT STATUS AND CONTROL ROUTINES ** **
 602 I=1
 604 IF Z(I)=1THEN 612
 606 IF A9=1 THEN OUT 2,A(I):Z(I)=1:GOSUB 700
 608 I=I+1:IF I=9THEN 200
 610 GOTO 604
 612 IF INT(RND(1)*10)>=5THEN Z(I)=0:C1=A(I):GOSUB 800
 614 I=I+1:IF I=9THEN 200
 616 GOTO 604
 690 REM ** ** PORCH LITE ROUTINE -- FIXED VALUES -- OUT2,24 CAN BE 2,XX ** **
 695 IF Z9=0THEN OUT 2,24:Z9=1:GOSUB 700:GOTO 200
 698 IF C=0THEN Z9=0:C1=24:GOSUB 800:GOTO 200
 699 GOTO 200
 700 REM ** ** ON BUTTON CONTROL ROUTINE ** **
 705 FOR L=1TO 30:NEXT L:OUT 2,0:FOR L=1TO 30:NEXT L:OUT 2,53:FOR L=1TO 30:NEXT

L:OUT 2,0
 710 RETURN
 800 REM ** ** OFF BUTTON CONTROL ROUTINE ** **
 805 OUT 2,C1:FOR L=1TO 30:NEXT L:OUT 2,0:FOR L=1TO 30:NEXT L:OUT 2,55:FOR L=1TO

30:NEXT L:OUT 2,0
 810 RETURN
 1000 REM ** ** ** SYSTEM STATUS ROUTINE (CNTRL-B) ACTIVATED ** ** **
 1005 T1$="** ** SYSTEM STATUS ** **":PRINT FN K$(T1$):PRINT
 1010 OUT 2,0:V9=0:FOR I=1TO T4
 1015 IF D(I)<>0THEN PRINT T3$;:GOTO 1030
 1020 NEXT I
 1025 PRINT T2$;
 1030 PRINT " CONDITIONS WERE MONITORED DURING YOUR ABSENTS:":PRINT
 1035 IF I=T4+1THEN RETURN
 1040 PRINT "(DAY)","(HOUR)","(MIN.)","(SEC.)","(ZONE)"
 1045 FOR I=1TO T4
 1050 IF D(I)=0THEN NEXT I:RETURN
 1055 PRINT D4(I),D1(I),D2(I),D3(I),D(I):NEXT I
 1060 RETURN
 1100 REM ** ** ** SYSTEM ERROR ROUTINE ** ** **
 1105 T1$="* ** SYSTEM ERROR ** *":PRINT FN K$(T1$):PRINT
 1110 IF C=9THEN 1130
 1115 PRINT TAB(5)"ERROR";C;"("
 1120 PRINT "THE FIRE ALARM ALONG WITH ONE OR MORE ZONE VIOLATIONS HAVE OCCURED.

  THIS"
 1125 PRINT "IS NOT A NORMAL CONDITION.  PLEASE CHECK SYSTEM.":RETURN
 1130 PRINT TAB(5)"ERROR";C;"("
 1135 PRINT "THE FRONT DOOR SENSOR ALONG WITH A ZONE VIOLATION HAS OCCURRED.  TH

IS"
 1140 PRINT "IS NOT A NORMAL CONDITION.  PLEASE CHECK SYSTEM.":RETURN
 1200 REM ** ** ** SET OFF ALARM ROUTINE ** ** **
 1205 IF V9=1THEN 200
 1210 B1=B1+1:IF B1<8THEN 200
 1215 D(T4)=C:D1(T4)=T1:D2(T4)=T2:D3(T4)=T3:D4(T4)=T4
 1220 B1=0:V9=1:IF T1>=6AND T1<=17THEN OUT 2,9:GOTO 200
 1225 OUT 2,51:FOR L=1TO 30:NEXT L:OUT 2,9:GOTO 200
 1300 REM ** * FIRE LIGHTING ROUTINE * **
 1305 OUT 2,51:FOR L=1TO 30:NEXT L:OUT 2,0
 1310 GOTO 200
 1400 END
```



These photos show the IC layout (left) and wire-wrap (right) of board "B". The same techniques are used on this board as were used on the "A" board. The relays are wired using copper strip since they are the PC variety. IC-type relays would use sockets and therefore could be wire-wrapped like the ICs.

(see box). It is written in BASIC, which is an advantage in that there are no speed requirements and modifications are easy to make. The only requirement is that any routine other than the time/tick-counter routine (lines 200 to 260) must be executed in at least 500 ms. If the general format of the program is maintained, the clock accuracy will not be altered.

Several possibilities or methods could be used in the case of fire. It is assumed here that it is night and you are asleep. If a fire starts, the first thing that happens is that the fire alarm goes off. The next is

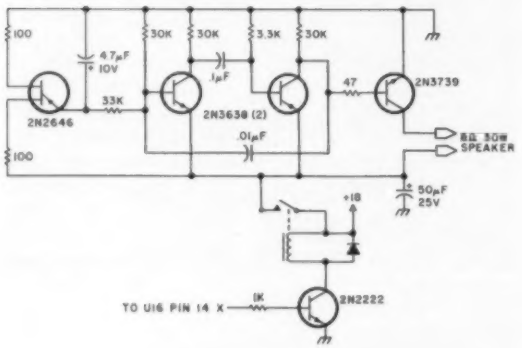


Fig. 8. Warble alarm.

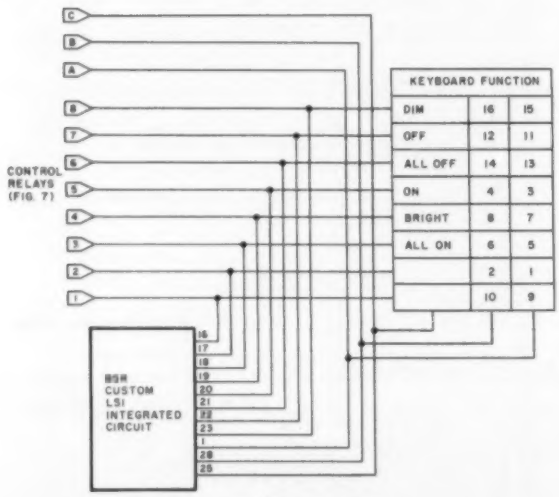


Fig. 9. BSR X-10 control.

SOFTWARE VARIABLES

A	Tick counter
A(1) thru A(8)	Preset light selection
A9	Random number used to determine various selected functions
B	Hi-byte counter
B1	False alarm counter (When count = 8, alarm is set off.)
C	Value read from I/O (alarm system)
C1	Temporary variable used to turn lights off
D	Zone storage element
D1	Hour storage
D2	Minutes storage
D3	Seconds storage
D4	Days storage (24 max.)
L	Relay bounce timing
P	Temporary clock storage
T1	Hours (front panel)
T2	Minutes (front panel)
T3	Seconds (front panel)
T4	Days (internal counter)
X	Temporary clock storage
Y9	Alarm check (1 = on, 0 = off)
Z(1) thru Z(8)	Light check (1 = on, 0 = off) (All random)
Z(9)	Front porch light status (1 = on, 0 = off)
0$	Set spacing for titles
K$	Same
X$	Same
T$	Variable titles
T1$	Same
T2$	Same
T3$	Same

that the lights come on (smoke-filled room), then a call (if selected) is made for you.

In lines 100 through 135, the value of "C" is used to determine what will happen next. If the value of "C" equals 8, then the front-porch light is turned on, but only if it is after six in the evening. If the value of "C" is equal to 16, the fire alarm is set off. If the value is 23, then the self-check message is printed. Any value suitable to your system installation can be used here.

Lines 200 through 265 should not be changed unless you are familar with the operation of the internal tick counter. A complete description of the clock routine can be found in the original article referred to earlier.

Decimal Input	C	B	A	8	7	6	5	4	3	2	1	Binary Code	Function
0												000000	Normal state
17			X								X	010001	
18			X							X		010010	
19			X						X			010011	
20			X					X				010100	
21			X				X					010101	
22			X			X						010110	
23			X		X							010111	
24			X	X								011000	
33		X									X	100001	
34		X								X		100010	
35		X							X			100011	
36		X						X				100100	
37		X					X					100101	
38		X				X						100110	
39		X			X							100111	
40		X		X								101000	
49	X										X	110001	Not used
50	X									X		110010	Not used
51	X								X			110011	All on
52	X							X				110100	Bright
53	X						X					110101	On
54	X					X						110110	All off
55	X				X							110111	Off
56	X			X								111000	Dim

Fig. 11. BSR X-10 function chart.

Random Timing

Line 520 plays an important part in determining when and if a light will be turned on. The object of this and the following lines is to make the house look lived in. A value for A9 of less than .001 will occur about 6 times in a 24-hour period. If a value less than .001 is generated, line 525 resets A9 to a random integer and then lines 600 through 616 provide the actual control. These values can be changed to suit individual living patterns.

Line 505 is the line that determines when the system will self-check. As now set, the system will check itself about 6 to 10 times a day. Line 585 does the actual checking via OUT 2,15.

Control-B

The function of the control-B is twofold. The first thing that happens is that the alarm is shut off. The next thing is that memory is searched for data. If no data is found, then line 1025 is printed. If some data is found, it is then read out via lines 1030 through 1045. It should be noted that some time will be lost when a control-B is used and there are several different items to list. This is a small problem because the services of the burglar alarm are usually over when this function is required.

Figs. 10 and 11 are the required input codes for the various output functions. Fig. 10 shows the values which control the functions of part (A), and Fig. 11 gives the values required to control the relays attached to the BSR X-10 control system.

Sensor Installation

Sensor installation will depend on several factors, including the types of materials used in the building. Fig. 12 gives examples of the major types of sensors used in this system. Installing the door sensor is about the easiest. Sensor contact is made by attaching small wires to nails or screws which are mounted in the hinge side of the door jamb. A small metal plate attached by nails or two-sided tape is mounted on the door. When the door is closed, the plate shorts across the nail (screw) heads, closing the circuit. Wires from the nails (screws) are run along the floor, rug, or, if necessary, through a small hole drilled in the doorstop. Caulking and paint will easily cover this small wire on the outside of the building.

Decimal Input	U10 Interconnect Pin 16	15	14	13	12	11	Binary Code	Remarks
0							000000	Normal state
9							001001	Sounds alarm
10	HI						001010	
11		HI					001011	Phone dialer
12			HI				001100	
13				HI			001101	
14					HI		001110	
15						HI	001111	System test

Fig. 10. Control functions.

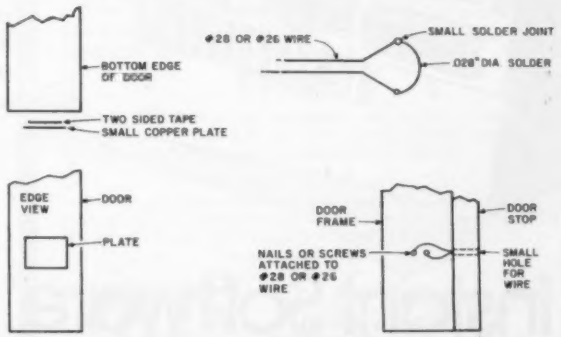


Fig. 12. Fire sensor design (upper right) and sensor-mounting tricks.

Aluminum frame windows and doors are the hardest to wire. If the window or door has an aluminum frame but a wood casing, the same method as used above can be used except that in this case the aluminum frame takes the place of the small plate. If both the frame and casing are aluminum, the best method seems to be mounting the screws on a small insulated block. Careful attention should be given to mounting so that an occasional open or always short circuit will not develop. Conductive tape can be used on windows if necessary. This tape is available from Radio Shack. In any case, use care to conceal the wire. A single wire can be used to loop around one side (zone) of the building with the return being brought directly back to the source (detector enclosure).

The galvanized plates are laid on a plastic mat to prevent current leakage through concrete or wet wood. The entire plate assembly is then covered with indoor/outdoor carpet. The carpet is glued down to prevent slippage.

Summary

This alarm system has been in operation for about one year. Various forms and layouts have been used and as yet only two false alarms were sounded. Both of these were caused by poor solder joints. Power for this alarm is taken directly from the H8 +18- and +8-volt bus. Any source which will provide approximately 500 mA (alarm on) will work. The system is built with CMOS devices and requires less than 1 mA for normal operation.

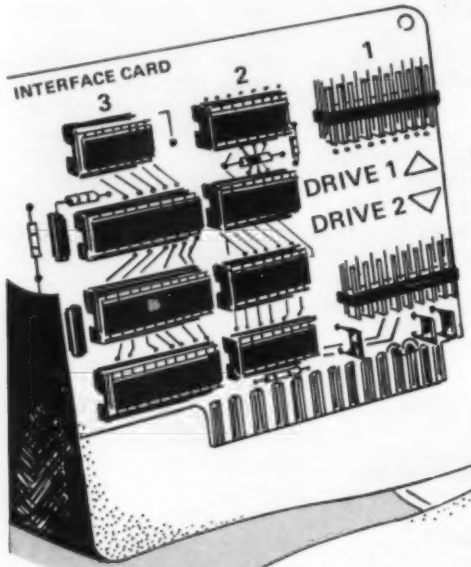
I hope you enjoy the same peace of mind that I do, should you try this system. ■

Parts List

Qty.	Type	Used For	Remarks
ICs			
2	4050B	U1 and U8	
2	4042B	U2 and U3	Pin 6 and 8 to Vss
2	4078B	U4 and U7	
2	4068B	U5 and U6	
2	4001B	U9 and U17	Unused inputs to Vss
2	4028B	U15 and U16	1 4514B substitute
1	4555B	U18	Unused inputs to Vss
2	4098B	U11 and U12	
Transistors			
2	PNP	Q15 and Q16	Any PNP type for Q16; not shown in Fig. 6
13	NPN	Q1 through Q14	2N2222 or equivalent
Opamps			
2	LM311	U13 and U14	Voltage comparator
Diodes			
11	1N914	Voltage suppressors	across relays
12	10 V	CR1 through CR12	100-mW zeners
Relays			
10	SPST	+12-volt DIP	
1	DPDT	+12-volt DIP	

Miscellaneous

All resistors are ¼ Watt. Capacitors are in uF and electrolytics are marked with a +. Circuit-Stik products are available in most parts houses or directly from Circuit-Stik, PO Box 3396, Torrance CA 90510. All components can be purchased from Godbout or James or from other advertisers in this magazine.



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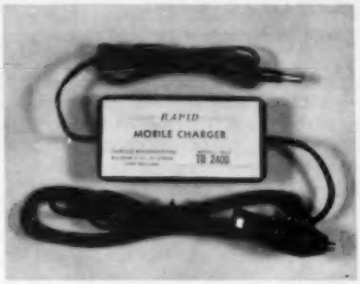

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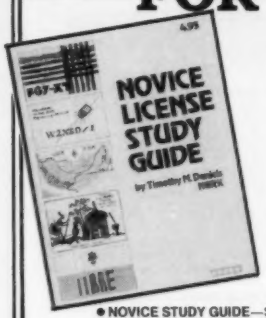

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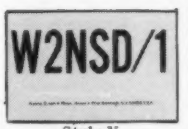

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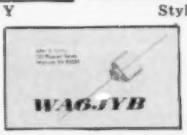

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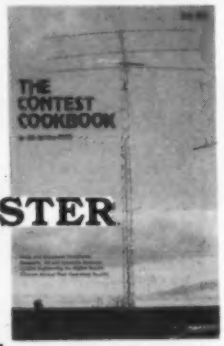

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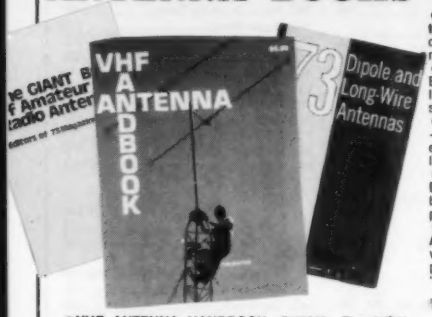

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- ☐ 1. High School
- ☐ 2. Some College
- ☐ 3. College Graduate
- ☐ 4. Post Graduate

B. What is your yearly income?
- ☐ 1. Less than $10,000
- ☐ 2. $10,000–$15,000
- ☐ 3. $15,000–$20,000
- ☐ 4. $20,000–$25,000
- ☐ 5. $25,000–$30,000
- ☐ 6. More than $30,000

C. How much have you spent on amateur radio in the last 12 months?
- ☐ 1. Less than $100
- ☐ 2. $100–$500
- ☐ 3. $501–$2,000
- ☐ 4. $More than $2,000

D. What brand(s) of antenna(s) do you own?
- ☐ 1. AEA
- ☐ 2. Antenna Specialists
- ☐ 3. Avanti
- ☐ 4. B & W
- ☐ 5. Bassette
- ☐ 6. Bilal
- ☐ 7. Butternut
- ☐ 8. Cushcraft
- ☐ 9. Daiwa
- ☐ 10. F9FT Tonna
- ☐ 11. Gem
- ☐ 12. Gotham
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- ☐ 14. Hustler
- ☐ 15. Hy-Gain
- ☐ 16. Kirk
- ☐ 17. KLM
- ☐ 18. Kreco
- ☐ 19. Larsen
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- ☐ 22. Mosley
- ☐ 23. Skylane
- ☐ 24. Stewart
- ☐ 25. Telrex
- ☐ 26. TET
- ☐ 27. Van Gordon
- ☐ 28. Western Electronics
- ☐ 29. Wilson
- ☐ 30. Other_____

E. What brands of HF and VHF equipment do you own?
- ☐ 1. Azden
- ☐ 2. Clegg
- ☐ 3. Collins
- ☐ 4. Drake
- ☐ 5. Heath
- ☐ 6. Hy-Gain
- ☐ 7. Icom
- ☐ 8. KDK
- ☐ 9. Kenwood
- ☐ 10. KLM
- ☐ 11. Melco
- ☐ 12. NCG
- ☐ 13. Santec
- ☐ 14. Swan Cubic
- ☐ 15. Tempo
- ☐ 16. Ten-Tec
- ☐ 17. Wilson
- ☐ 18. Yaesu
- ☐ 19. Other_____

F. Are you now on RTTY?
- ☐ 1. Yes
- ☐ 2. No

G. If not, are you interested in getting RTTY?
- ☐ 1. Yes
- ☐ 2. No

H. Would you favor a no-code license if ham clubs were placed in charge of licensing?
- ☐ 1. Yes
- ☐ 2. No

I. Would you like to see articles on satellite TV in 73?
- ☐ 1. Yes
- ☐ 2. No

J. Which of these magazines do you read regularly?
- ☑ 1. 73
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- ☐ 3. *QST*
- ☐ 4. *World Radio*
- ☐ 5. *Popular Electronics*
- ☐ 6. *Radio Electronics*
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- __ 1. 1
- __ 2. 2
- __ 3. 3
- __ 4. 4
- __ 5. 5
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105	110	115	120	125	230	235	240	245	250	355	360	365	370	375	480	485	490	495	500

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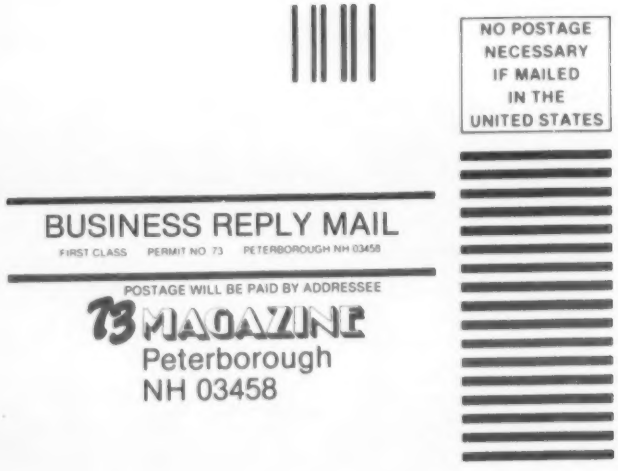

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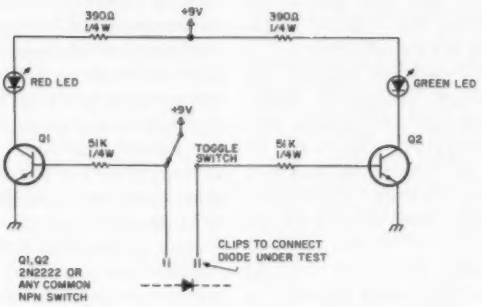


Fig. 1. Diode-tester schematic.

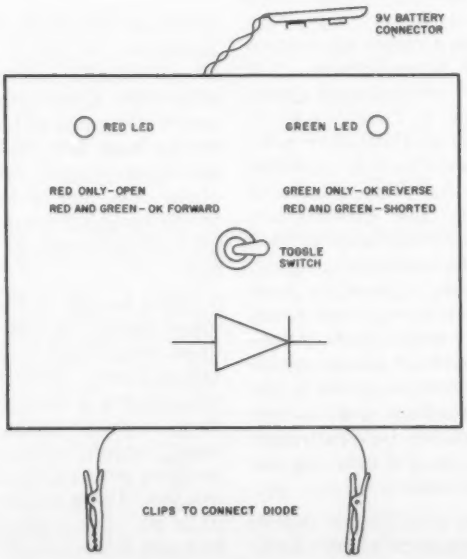


Fig. 2. Front-panel layout.

For many years I have used my ohmmeter to test diodes. The usual technique was to set the meter on R × 10, fumble with the test leads to get a "low" reading (OK in the forward direction), reset the meter to R × 100 or R × 1000, refumble to reverse the diode, and check for a "high" reading (OK in the reverse direction). Usually, around the second fumble I would lose track as to whether I actually reversed the diode and would have to fumble a few more times to recheck.

Recently, I purchased a bag of 100 untested switching diodes, and anticipating a long evening of lead switching, testing, and retesting, I decided to build a simple diode tester. Construction time was about 15 minutes, a good investment if you occasionally or more than occasionally test diodes.

The circuit shown (Fig. 1) was built in a 3" × 4" × 1" plastic box. Three holes are drilled: one for each LED and one for the toggle switch. The "instruction plate" was written on a self-stick label and mounted just above the switch. Two test leads with clips are brought out to connect with the diode as shown by the symbol drawn just below the switch. Fig. 2 shows the physical arrangement of the front panel.

A standard 9-volt battery connector is brought out the back to power the circuit. I recently have standardized all of my small test instruments on 9 volts and bring out the connectors. When I want to use an instrument, I simply connect a 9-volt battery, thus saving on power supplies and multiple batteries for instruments I only occasionally use.

Operation of the tester follows the "instruction plate." Connect the diode, throw the toggle switch to the left, and check that both the red and green LEDs are on. If only the red LED fires, the diode is open. Now throw the toggle to the right; only the green LED should be on. If both the red and green LEDs fire, the diode is shorted. Note: If the diode fails both tests, you probably have connected it backwards. Thus, the tester also can be used to find the polarity of unmarked diodes.

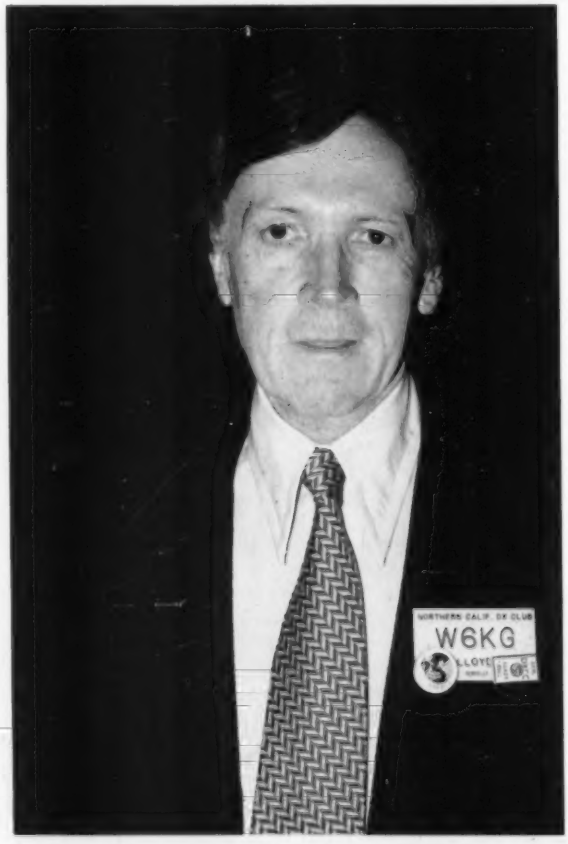
Caution: Many toggle switches connect the center terminal to the end terminal opposite the direction of the toggle handle. When the toggle handle is to the left, the center and right rear contact (as viewed from the front) are connected. Check yours out with an ohmmeter before wiring it in accordance with the schematic. ■

Chris Brown KA1D
73 Magazine Staff

In Profile: Lloyd and Iris Colvin, The DXpeditioners

Lloyd and Iris Colvin are living a dream that all DX-oriented amateurs have envisioned at least once. It's a dream of unlimited travel toward receding horizons, of financial security and international celebrity status. It's a dream of going to the sun, setting up a shack, and, for once, operating as the hunted rather than the hunter. It's a dream of being DX.

For the past 16 years, the Colvins have been on the move. The statistics listed on their Yasme Foundation QSL card tell the story: traveled to 142 countries, worked over half the active amateurs in the world, achieved DXCC 56 times under various callsigns, received over 350,000 QSL cards, worked 354 countries, won 400 awards including the first *CQ Magazine* WPX Certificate.



Lloyd Colvin.

Tanned and healthy, the Colvins approach retirement age with energy and enthusiasm instead of dread. Part of the reason is their lifestyle. Financially secure and unfettered by family or business constraints, they are free to roam the world together in an ongoing DX odyssey.

Under the auspices of a tax-exempt foundation called Yasme, they have made a career of amateur radio DXpeditioning. With an affinity for travel gained during a 23-year military career and a love of radio communications spawned in the early days of amateur radio, the Colvins are uniquely equipped to meet the demands of their gypsy lifestyle. Operating from seldom-heard coral atolls, newly-established African countries, or lavish Caribbean island playgrounds, the Colvins have long fascinated those less-fortunate souls on the opposite end of the circuit.

But what does it take to globe-trot constantly, to be without home and family much of the year? How is it possible to be so dedicated to amateur radio that, no matter how unusual or exotic the locale, rarely a day goes by without time spent at mike or key?

And what of Yasme? Where does the family stop and the Foundation begin? How does this tax-exempt corporation function? Is it a building or a box in the Castro Valley, California, post office? How are the donations used and what degree of financial support does Yasme sponsorship entail?

These questions are just a few of many asked during an afternoon spent with Lloyd and Iris Colvin—the DXpeditioners.

73: Lloyd, what is Yasme all about?

Lloyd: Actually, it all started in 1954. A young fellow named Danny Weil built a 19-foot boat with his own two hands. Danny was an Englishman, and he hoped to sail around the world in the little boat that he had built.

When he got to the US Virgin Islands, he met Dick Spenceley KV4AA. Dick said to Danny, "Why don't you become a radio ham? Then, as you go around the world, people who enjoy speaking with exotic countries would have the chance to do so. They might even help you financially in pursuing your trip around the world."

73: So Danny Weil wasn't licensed when he began the trip?
Lloyd: No. He was not a radio ham and he didn't know the code. But Danny accomplished something about only one man in 100,000 could. He learned the code, got his license, and was on the air working pileups at 20 words per minute within one month after starting from scratch. He then proceeded to go out to many exotic places with a rig and give many people new countries.

Well, Danny never quite made it around the world, but he did sail over 25,000 miles. His boat was called *Yasme*—that's a Japanese word meaning "good luck."

In 1961, the Yasme Foundation was formed. Its main goal was the collection of money to keep Danny going. This worked out well until 1964, when Danny met a young lady on one of his stops and they got married. They went out on a few more voyages together and almost lost their lives in mishaps at sea.

There were five *Yasme* boats from the beginning of Danny's odyssey to the end. All now rest on the ocean floor.

73: Is Danny Weil still alive?
Lloyd: Yes, he's still alive. He is living in Texas now and he's about fifty years of age. He gets on CW frequently, but he does not hold a call of his own in the US.

73: So, in 1964 the Yasme DXpedition torch was passed to you?
Iris: Yes. We had always thought about going out on a DXpedition, and in 1964 I said to Lloyd, "Why don't we go?" We contacted Yasme because we knew it was still active, although no one was out at the time. We asked if they'd sponsor us, and they said yes.

73: What did Yasme sponsorship entail?
Iris: They had no money in the Foundation at that time, but we paid our own way, anyhow, so it didn't matter. They provide a big service for us in the way of QSLs. The donations they receive help with that. They also helped with licensing in countries where we had trouble.

73: So you're operating as independent hams under the umbrella of the Yasme organization?
Iris: Yes, that would describe it well.

73: Are there other people in the same situation in Yasme or are you two the only active DXpeditioners?
Lloyd: There have been others in the past. One of the most noteworthy is George McKercher WØMLY. He is now a director of Yasme. He made a Yasme-sponsored trip to many of the countries of Africa in the 60s. There have been a couple of other people who have gone out under the sponsorship of Yasme, also.

We are finally approaching the activity of Danny Weil. He was out continuously for nine years, you know. We have been out actively from 1965...16 years in all. We frequently take a few months off and go back to California for a rest. We still have a business there that we're connected with.

73: I see. Is Yasme headquartered in California?
Lloyd: It is, but it is incorporated as a nonprofit corporation in Florida.

73: Does Yasme have an office and phone, or is it just a mail drop?
Lloyd: Well, for nearly 16 years now we have had the same PO Box—2025, Castro Valley, California—that's been a help because people always know that they can get a card from us at that address.

73: So, no full-time, paid office staff?
Lloyd: No.

Iris Colvin.

73: You must receive thousands of QSLs each month. How and by whom are they handled?
Lloyd: We have had a number of Yasme people who have helped with the QSLs.

Today, Iris and I have the largest QSL collection in the world. I don't think there is anyone else who has more cards than we do. All of them are arranged in alphabetical order and stored in a huge metal cabinet. Our files number in excess of a third of a million cards at present.

73: That's amazing!
Lloyd: There are some other amazing statistics about our QSL collection. For one, the weight. We're a little worried about the structure of our home which, incidentally, we built. It was designed to carry a good load, but the QSLs we have amassed weigh over a ton!

Also, putting this collection in the state it's in now has taken lots of work. For example, if it takes a minute and a half to answer a card, file it, etc., when we receive one, it would take one person working forty hours a week three years just to file the cards we have received to date.

73: How do you confirm a contact for a new country? Do you check back against the log?
Lloyd: Yes, we do. We use a log system that Yasme has used ever since we've been connected with it. We can thank the infamous Mr. Don Miller W9WNV for designing it. In fact, he gave us the first copy of the log we use. It's a good system and we have used it for as long as we've been operating.

It consists of a small form with attached carbon, about five by seven inches in size. Each sheet holds 100 entries and when a sheet is full, we send the carbon to Yasme for filing and verification.

73: And the folks at Yasme verify the contact and then QSL?
Lloyd: Yes, and Yasme has had over 100 people help with this over the years.

73: Are all these people volunteers, or are they paid?
Lloyd: They are all volunteers. Nobody gets a cent. Nobody has ever received any money in the headquarters of Yasme, either. Right now, we have one lady who is single-handedly answering all of our cards. She is Carolyn Brand WA6AKK.

SOME OF THE COLVIN CALLS

W6KG (Lloyd)—W6QL (Iris)—
FA8JD—J2AIH—J2USA—
DL4ZC—KG6SV—KC6SZ—
VR1Z—GD5ACH—ZB2AX—
GC5ACI—CT3AU—CT2YA—
6W8CD—5T5KG—ZD3I—
9L1KG—5L2KG—9G1KG—
TU2CA—5V1KG—TY2KG—
VR8B—3D2KG—C21NI—
FKØKG—YJ8KG—ZF2CI—
W6KG/-AJ3/TI5/6Y5/VP2A

We've just returned from four months of operating during which time we made over 55,000 contacts. This poor lady is receiving over 25,000 QSLs from that trip alone.

Iris: Lloyd, we should also give credit to W6RGG—Bob Vallio. He was our first secretary and he did all of our cards in years gone by.

73: How did you folks acquire the DXpedition lifestyle, the constant going?

Lloyd: We started our world travels while I was in the service. I've had one career in the military and a second afterwards. I was in the Army Signal Corps before World War II. I was a radio ham when I was 12 years old and have been one for 52 years now. Iris became a ham as soon as we got married, so she's been a ham for 37 years.

Actually, I got into the Signal Corps through ham radio. In fact, almost everything we've done in our lives has been directly connected with ham radio. I guess I found my military life interesting because much of it was similar to running ham stations.

73: And I imagine you did a fair amount of traveling during your military years?

Lloyd: That got us started traveling, yes. We've now been to 142 countries, and about half of those were visited while I was in the military service. I spent 23 years in the military and retired in 1961 with the rank of Lieutenant Colonel.

73: How did you get into DXpeditioning?

Iris: When we decided to go on our first DXpedition, in 1965, we sold our house, closed out the five construction contracts we had going, advertised for and found a good home for our dog, and then left. Our intention was to go out indefinitely.

Well, after three an a half years we got tired and went back to California for a rest. Now we have a different house; it's a place we can go back to as a home base and it even has a permanent amateur radio station.

73: You said that you had a business in California. What type of business is it that allows you to be away so much?

Lloyd: Well, when I left the military, we went immediately into the construction business. We started out building homes and then went on to larger projects like apartment houses, hospitals, and office buildings. Today, I'm the president of Drake Builders of California and Iris is the vice president.

"Almost everything we've done in our lives has been directly connected with ham radio."

73: I see. Since you're away so much, I imagine you must have a reliable manager working for you.

Iris: We're no longer in the construction business. Today we own several apartment buildings which require occasional looking after but not daily attention. My daughter and her husband look after the day-today cares of the business. In fact, she's a ham, or was. Her call was W4ZEW, but it has expired. It hasn't been reissued though, so maybe she could get it back.

73: Ham radio seems like the ideal way for her to keep in touch with you when you are in hard-to-reach places, places, say . . . like China. I assume you folks are interested in China?

Iris: Yes. We've been working on it, but we don't know how to break the permission barrier.

73: Have you personally made any overtures to the Chinese government?

Lloyd: Yes. In fact, we had a rather interesting experience while making an effort to gain permission to go.

Back in the last days of the Nixon administration, I read that Secretary of State Kissinger was going to China. I sat down and wrote a letter, giving him the full story on ham radio. I told him that Iris and I would dearly like to go to China and asked him to please do something to help us get into Red China with an amateur station.

We never knew for sure whether he read our letter, but eventually we got a letter from a fellow in the State Department saying that Secretary Kissinger had directed him to respond to us. He provided us with the names and addresses of the four Chinese that they thought were most likely to be in a position to help us.

We wrote to these four people and after many months received an answer from one of them. It was a very short letter, written in Chinese, about a third of a page long.

Not being able to read Chinese, we assumed that it said no, simply because of its length. We took it to an interpreter and, after it was translated, the third of a page became two full pages. One Chinese character can have the same meaning as a full English sentence.

It was a rather interesting answer, and it went something like this: It said that our letter had been received, and they wished to tell us that when our country saw fit to fulfill all the promises made by President Nixon on his recent trip to China, it was possible that favorable action would be taken on our request to operate.

73: We know what happened to Mr. Nixon after that. How do you assess the political situation there today? Do you sense an easing of tensions?

Lloyd: Right now, the Chinese are operating low-powered transmitters in the 80-meter band, so they know what ham radio is. Though they are not permitted to contact the outside world yet, it is my opinion that the day is coming.

73: Do we need some ping-pong diplomacy in ham radio?

Lloyd: Yes. I think a group of hams going over there the way the ping-pong people did could make great strides in furthering the amateur cause.

Iris: The Chinese don't seem to want their people to contact the outside world. That's the stumbling block. If there were some way we could overcome that . . . we might get somewhere. Right now, they are just afraid to have their people have any contact with the rest of the world.

73: In all such matters I imagine you've got to be part politician to make any progress. You both must be quite adept at working your way through bureaucracies after all your dealings with foreign governments.

Iris: That's one thing that you've got to do. I remember an instance in Africa back in 1971 when many of the countries were being formed. In one place we visited, we felt that they were willing to let us operate but we sensed that there was another problem.

They simply didn't know how to go about granting an amateur license. They had never had to do it before, having had no amateur service of their own. They didn't even know what a ham license should look like.

We told them that we had licenses from many

other countries that we'd be happy to let them inspect. We did so, and the next day were granted a license that looked much like some of the ones we had left with them.

Lloyd: We sensed that they didn't know how to issue a ham license but we couldn't just say, "Hey, don't you guys even know how to issue an amateur license?" Instead, we said, "Why don't we leave these other licenses with you overnight?" When we finally got our license we saw that they had copied almost word for word from our other licenses. Diplomatically speaking, we came in the back door.

73: It's hard to envision a country without an amateur service, but I suppose they exist, don't they?

Iris: They do, and it's a problem for them to issue licenses to people like us.

73: I'm curious about the scenario of a Colvin DXpedition. What happens when you arrive at a new place? Do you have a tech crew that gets everything up and running for you?

Iris: Sometimes yes, sometimes no. One of the things that we do differently than some smaller operations is that we take a full kilowatt station and a directional antenna along wherever we go. We take a three-element beam, a rotator, a linear, and a transceiver. The whole package weighs about 400 pounds.

It's been a lot of trouble to carry around, and a big expense, too. But, as a result, wherever we have gone we have put out a very good signal and given anybody who wants to work us the opportunity. That's our criterion of operation and that's what we've been doing.

73: Do you ship all this gear ahead or do you travel with it?

Lloyd: We have tried many different ways of doing it. When we can, we ship it ahead, but that isn't always possible. When we put the new country of Tuvalu Island on the air under the call of VR8B, we shipped the gear ahead and, fortunately, it was there when we arrived.

Iris: We prefer to take the gear with us instead of shipping it; that's the ideal way. On the other hand, if you don't have a license when you go in, you may have a problem getting it through customs.

Lloyd: In that connection, we have changed some of our ways of carrying gear. During the first ten years of our operation, we always carried it in the manufacturer's packing material—bulky boxes, Styrofoam® packing, etc.

About two years ago, we found a better way to move the main part of our station. Now, I take the transceiver aboard the plane as carry-on baggage. I don't wrap it up at all, so everyone can see what it is. Iris does the same with the linear.

There are some real advantages to this. First, nobody can ever accuse us of sneaking anything into a country because the gear is right out where everyone can see it. Second, all the large, bulky packing material is eliminated. And most important of all, the gear doesn't get lost. Our personal bags and clothes may, but even if they do, we still have the ham station and, to me, that's most important. You can operate in your underwear, but you can't operate without the rig!

Iris: The hippies have helped us out in this regard.

73: The hippies?

Iris: Yes. It's the "in thing" today to carry one of those great big radios around with music blaring. In the streets of San Francisco these days, there are so many that they interfere with each other. As a result, we have had very little trouble carrying our transceiver around. Everyone assumes it's a radio.

73: Speaking of equipment, what type of gear are you using?

Lloyd: We use an old Heath SB-230 linear that weighs 30 pounds. With all the advanced technology we have today, we still can't find anything that will run a kilowatt and weighs 30 pounds.

When we started, years ago, we were using a Collins. Later we switched to Kenwood, and today we are using a Yaesu. All these rigs worked very well for us, especially when you consider that we have had something in the neighborhood of 400,000 QSOs, all with very little technical trouble. We really take our hats off to the manufacturers.

"We've been forced into being the good guys by Don Miller."

73: Lately, many DXpeditioners seem to be having a large number of power-line-related problems. On your trips, do you take any precautions to limit power-line variations?

Lloyd: No. In fact, we're astounded at how well the equipment we've used has held up under considerable variations of input power.

On our very first trip, we took a Variac with us. Soon thereafter, we eliminated it because we found that the commercial equipment we were using worked well with a variation of input voltages in excess of 15 percent. We don't carry a Variac with us now or take any special measures to protect the rigs.

Everywhere we go we are looking for new, lightweight equipment—anything to improve our ability to carry a station with us. Some of the advances have not been as great as we'd have liked.

For example, we are still using the same antenna that we carried with us 15 years ago because we can't find one that is smaller or better. When an antenna comes along that is lighter and better than the Hy-Gain TH-3, we'll buy it immediately!

73: I've always been mystified by the DXpedition that goes to an exotic place, whose members then lock themselves in a room with a rig for a week. They see very little, if anything, of the country. When you are on a DXpedition, do you get around the country and meet the people?

Iris: We sure do. That's the reason that we usually try to stay at least a month in a place. It gives us an opportunity to rent a house or apartment and get out and around. We more or less live with the people wherever we go.

We do like to contact as many people as possible and, in a month's time, most of those who wish to, contact us. We still have time for sightseeing, though, even when we operate 12 hours a day.

Lloyd: And, when we've left a country, our memories are of the people we've met there, not of the actual on-the-air operation. When we look back on it afterwards, it's the people we've met that seem to be the outstanding thing about the visit.

73: You two have been referred to as the premier ambassadors of amateur radio. How do you feel about that?

Lloyd: Well, we have been forced into being the good guys by Don Miller. When he was out he frequently ran into trouble with both the local authorities and his fellow hams. He was occasionally not licensed for, or even located in, some of

There has never been a better time to subscribe to 73.

Ever.

See page 147

the places he claimed to operate from.

We once spent two and a half months in a rare country, with our gear, and couldn't get a license. In spite of that, we never fell for the temptation of getting on the air illegally. We've always had legitimate licenses on all our trips. We also have made it a special point not to commit any type of minor crime in any country we visit, such as operating without proper permission or not paying all our bills.

73: I imagine it's hard to keep up with all the different rules of these countries with regard to frequencies available.

Lloyd: It's not so much keeping up but rather dealing with the annoyance of being in a country where you can't operate on a frequency that you did the previous month in another country. For instance, there are some countries now that allow their amateurs only a 100-kHz segment of 80 meters. During our operations, it is a great temptation to try to go where the Americans are operating on 80 meters, but often we are unable to do this—and we don't.

73: Strictly by the rules then?

Lloyd: Only where the local government says you're supposed to operate, yes.

73: I'd like to hear your views on the bogus DX QSL card incident. Dave Gardner's claim that the scam was merely an effort to demonstrate to the ARRL the shortcomings of its own DXCC program met with little sympathy in most circles.

Lloyd: I have no sympathy for him, I'll tell you that.

73: Were you at the 1980 Fresno DX Convention where the plot was supposedly hatched in a secret meeting?

Lloyd: I was at the Fresno convention, but I heard nothing about a secret meeting, much less bogus QSL operation. If I had, I'd have probably gone to the League myself. What Dr. Dave Gardner did was just plain cheating, and you can quote me on that.

73: In a statement to HR Report, *Gardner implied that a large number of DXers and DXpeditioners were involved. Do you think this is the case?*

Lloyd: I doubt it. I think this was his idea and his operation. The sad thing is that as a result of all of this, people are going to lose faith in DXing and also in amateur radio. The impact of this will be terrible for amateur radio.

73: How do you feel about the no-code license?

Lloyd: We are not in favor of it. It seems to me that we must not lower the standards of amateur radio to those of CB. We have a little something special with the code requirement. Though many say CW is a thing of the past and we don't need it, it never seems to disappear completely.

73: Do you feel that in this era of liberalization it is difficult to maintain standards in amateur radio?

Lloyd: To a degree. However, I don't go along with those who say that the conditions on the bands today are worse than in years gone by. As I look back at my early days in the hobby, and I started in 1929, I'd have to say that it was just as bad or worse back then. People have just forgotten.

In 1929, when two people in the same city got on the air they QRMed each other so badly that neither could hear anything, even if they were on opposite ends of the band. It's simply not true to say that things are worse today than in the old days.

As far as politeness goes, we are in no worse shape today than we were in 1929. When I first became a radio amateur, we had 35,000 hams in this country—that's all. We have ten times that number today, and while there are more troublemakers around, the ratio is just about the same as it was in 1929. I don't really think that conditions today are any worse than when I started.

73: Iris, I read an interesting statistic recently in QST. *They conducted a survey of amateurs and found that the number of women becoming involved in ham radio is on the increase. Any comment on that?*

Iris: Oh, I think that is definitely true. I also think that women are becoming better operators, too. I usually try to contact the YLs, and I've noticed recently that the YLs are much more self-confident in pileups. They talk slowly, seem more poised, and in general are capable of making contacts in good style.

73: How about plans for the future. Other than China, are the Colvins planning anything exciting?

Lloyd: We laughingly tell everyone we meet that we hope to operate from every country in the world. We know this is an impossibility, but it is a goal that we can keep in front of us—something to make life and ham radio more exciting.

73: So, as you look down the road, you see more of the same: the travel, the DX operations, the going?

Lloyd: That's right, yes.■

"We must not lower the standards of amateur radio."

Antonio G. O. Gelineau W1HHF
142 Home Avenue
Burlington VT 05401

Ringo Ranger Redux

—add those radials for better performance

After reading the very excellent article by Robert Glorioso W1IS in the May issue of *73*, and having a Ringo Ranger, my interest was stimulated to experiment with adding ground-plane radials.

I cut six pieces of aluminum wire to lengths of 20 inches (50.8 cm). As an aid to spacing them around the base mounting of the antenna equally, I placed a strip of 1" masking tape around the base, brought the ends together, and marked them as shown in Fig. 1(a).

Using a marking pencil, I made a line to indicate where one radial was to be placed. Removing the tape, I then made lines equally subdividing the distance between the two original marks—see Fig. 1(b). The marked tape was then placed on the base mount of the antenna as shown in Photo A.

Next, I placed a 2" hose clamp above the marked tape, but did not tighten it. I slid the aluminum rods under it one by one at the marks, holding each in place with a piece of masking tape. When all six rods were in place and aligned, I secured them by tightening the hose clamp, as shown in Photo B.

Using the handle of an adjustable square which had a designed angle of 45°, I bent each rod to a 45° angle as shown in Photo C.

My findings on adding radials to the Ringo Ranger were the same as those of W1IS. There is an improvement in received signals from repeaters and considerable improvement when working simplex. ■

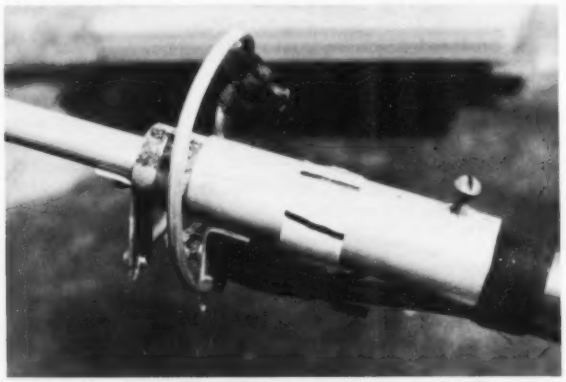


Photo A.

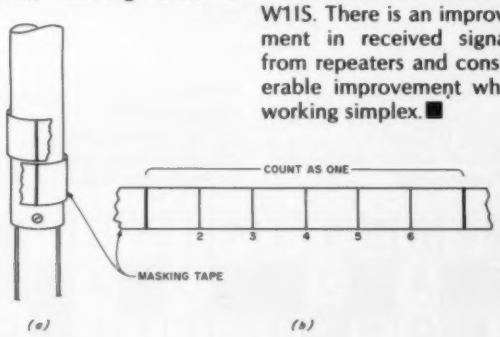


Fig. 1.

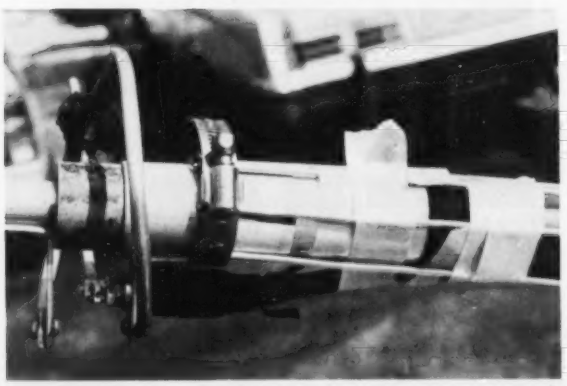


Photo B.

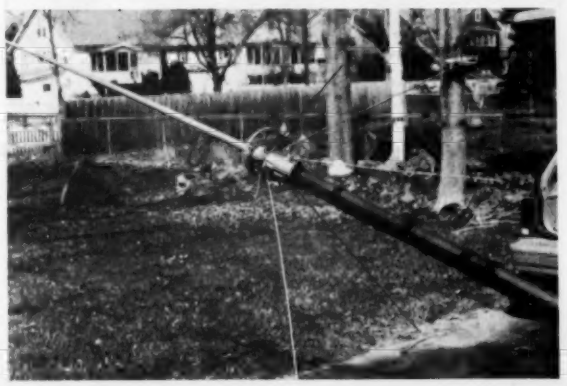


Photo C.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

CONTESTING

Ahhh, the weekend. Two solid days to ignore work and tune the airwaves. What? The XYL has chores? Too bad. Today's the day to have some long anticipated rag-chews. Anyway, it looks like rain.

But one flick of the power switch finishes all those pleasant thoughts. No rag-chews today—*it's another contest weekend!* A spectrum full of anxious amateurs, eager to give anything that talks a 59 signal report.

Not since the incentive licensing debacle have feelings run so high. Contesting is one of those searing issues that immediately crystalizes amateur radio into two opposing camps. The only middle ground is here, in FUN!, where both lovers and haters can prove their contesting knowledge.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) Contest bonuses
7) Unhardy contester
10) 1970s U.S. prefix
11) Popular contest starting day
12) Pacific prefix
14) Popular antenna
17) Night (abbr.)
18) Civil defense (abbr.)
20) Call-oriented test (2 words)
21) Preliminary result: ____ score
23) Guatemala prefix
24) Twice-worked stations
26) Soviet satellite (abbr.)
28) Between nations
30) Home power type
31) HF wavelength (abbr.)
32) November contest

Down

2) The non-initiated
3) Infinitesimal
4) Identification (abbr.)
5) Electromagnetic communication
6) System of communication
7) Informal contests (2 words)
8) A Soviet prefix
9) Summer contest
13) CW chuckle
15) Gone to ruin
16) Mr. Last Place
18) Bolivia prefix
19) ARRL contest
20) CQ contest (abbr.)
22) Repeat (abbr.)
24) To fall in standing
25) Contesters can't wait to hit this at end
27) _____ up first place
29) Two winners
31) 32 across (abbr.)

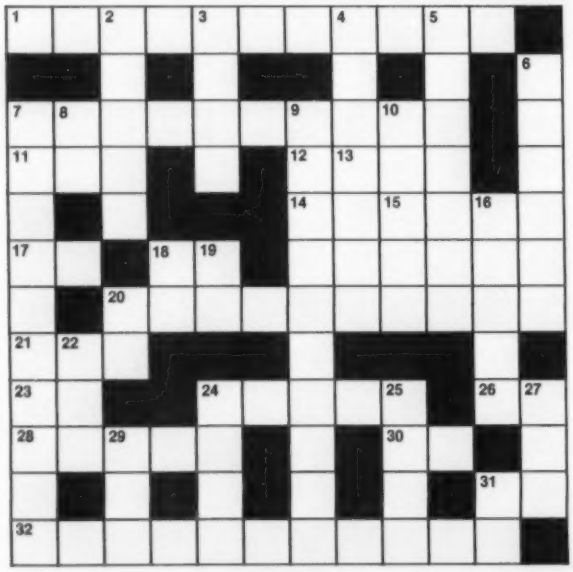


Illustration 1.

ELEMENT 2—TRUE-FALSE

	True	False
1) It's quite legal for contest organizers to offer prizes.	____	____
2) A Novice won the 1954 ARRL CW Sweepstakes.	____	____
3) Most contest organizations disqualify entrants submitting logs with errors totaling more than 2%.	____	____
4) The North American Sprint is sponsored by the *National Contest Journal*.	____	____
5) It's possible to enter many contests without even transmitting.	____	____
6) The March, 1921, *QST* suggested a CQ party. On April 1, according to a specific schedule, all amateurs in a given call district would send CQ.	____	____
7) The first ARRL Sweepstakes was held in January, 1930.	____	____
8) The winning operator in the first Sweepstakes worked 153 stations in 43 sections.	____	____
9) The first Field Day took place in January, 1933.	____	____
10) The first winning Field Day station had six operators and accumulated a grand total of 60 contacts.	____	____
11) The Radio Society of Great Britain and the ARRL once cosponsored a contest.	____	____
12) The 1952 Novice Roundup had 100% greater participation than the previous year.	____	____
13) In November, 1931, the ARRL sponsored a "Crossband Get-Acquainted Party" to "promote fraternalism and versatility" between 40- and 80-meter operators.	____	____
14) From 1942 through 1945, U.S. hams were forbidden to have contest QSOs with German and Japanese stations.	____	____
15) The 1977 Novice Roundup was the first to include Technicians.	____	____
16) The ARRL, *CQ Magazine*, and *73 Magazine* have all sponsored 160-meter contests.	____	____
17) The ARRL "Copying Bee" was a receiving contest that specialized in tricky text and code combinations.	____	____
18) The VHF Marathon was a 1946 contest that lasted eight months.	____	____
19) The Southpaw Fist Contest is devoted entirely to left-handed brasspounders.	____	____
20) The NBVM Sweepstakes is a contest for narrow-band voice modulation devotees.	____	____

ELEMENT 3—SCRAMBLED WORDS

Unscramble these words associated with contest operating.

foceef	olg	mutrecop
cocik	phrocmenoi	eyerk
linpce	peadenohsh	tations
	neatnan	

ELEMENT 4—MATCHING

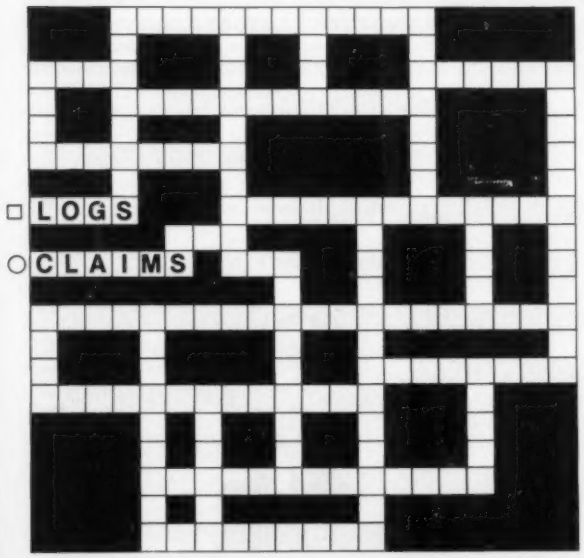
Match the contests listed below with the month in which they take place.

Column A	Column B
1) Field Day	A) January
2) IARU Radiosport	B) February
3) *CQ* WPX (Phone)	C) March
4) ARRL Novice Roundup	D) April
5) *CQ* Worldwide (CW)	E) May
6) CAN-AM Contest (CW)	F) June
7) ARRL VHF Sweepstakes	G) July
8) Straight Key Night	H) September
9) *CQ* Worldwide (Phone)	I) October
10) County Hunters SSB Contest	J) November
	K) December

ELEMENT 5—HAMAZE

Here's a new type of maze geared specifically to hams. The object is to start at the circle and trace your way to the square by filling in the answers to the clues given below. To help you on the way, we've already given you the first and last clue answers. All words read either vertically downward or from left to right. Each new word is on a *perpendicular* angle to the previous word. Words join on a common letter. Good luck.

1) Contest records (given)
2) Sometime domestic multipliers
3) Specialized mode
4) West coast contesters (abbr.)
5) Station timepiece
6) Automatic key
7) Station's heart
8) To make advances
9) Novice contester's speed
10) European award (abbr.)
11) Contest QSO
12) Top ticket
13) Topside metal
14) Beam reckoning
15) Total
16) Ham letter words
17) DX encounter
18) Contest sleep
19) What you're reading
20) Output (abbr.)
21) QSOs ___ minute
22) Postscript (abbr.)
23) Sources of assertion (abbr.) (given)



SCORING

Element 1:
Twenty points for the completed puzzle, or 1/2 point for each question correctly answered.

Element 2:
One point for each correct answer.

Element 3:
Two points for each word unscrambled.

Element 4:
Two points for each contest matched to its correct month.

Element 5:
Twenty points for the completed puzzle, or one point for each word.

How did you do in this contest?

1-20	points—"Why is the League wasting my dues on these contests?"
21-40	points—"Contests? I can take 'em or leave 'em."
41-60	points—Third place—Manitoba QSO Party.
61-80	points—"Mr. Clean Sweep."
81-100+	points—They won't let you enter any more contests—you're too good.

FUN! MAILBOX

I think Dave Mann's shot at you in the July "Leaky Lines" was uncalled for. To me, your column will always have taste.

Jonathan Bird KA0BYW
Hopkins MN

As my nephew, Paul David Mann (no kidding) always says: "With a little MSG, it'll even taste better."—J.E.

THE ANSWERS

Element 1:
See illustration 1A.

Element 2:
1—False Not in the United States. Actually, small prizes such as plaques and cups are okay, but the FCC tends to frown on anything more substantial.

M	U	L	T	I	P	L	I	E	R	S	
		A		O			D		A		C
Q	U	I	T	T	E	R		W	D		O
S	A	T		A		A	H		I		D
O		Y				D	I	P	O	L	E
P	M		C	D		I		O		O	
A		W	P	X	C	O	N	T	E	S	T
R	A	W				S				E	
T	G			D	U	P	E	S		R	S
I	N	T	E	R		O		A	C		E
E		I		O		R		C		S	W
S	W	E	E	P	S	T	A	K	E	S	

Illustration 1A.

2—False But it would have been something.
3—True Be careful.
4—True Great contest and a great group.
5—True Sure. Haven't you ever heard of SWLs?
6—True We think it was meant as a joke.
7—True It was designed as an exercise in traffic handling.
8—True Today, even I do better than that.
9—False No, June, 1933. January's too nippy.
10—True Portable work was tough in those days.
11—True In 1934, a 10-meter contest.
12—True Since 1952 was the Roundup's first year...
13—True Could we make that up?
14—True And because of World War II, anyone else, too.
15—True Techs got their low-band privileges the summer before.
16—True And W1BB has worked them all.
17—True Fifty years ago—sounds like fun.
18—True I wonder when they slept?
19—False Gee, I could enter that one.
20—False It would have to be an ARRL contest.

Element 3:
(Reading from left to right) coffee, log, computer; clock, microphone, keyer; pencil, headphones, station; antenna.

Element 4:
1—F, 2—G, 3—C, 4—B, 5—J, 6—H, 7—A, 8—K, 9—I, 10—E.

Element 5:
See Illustration 2A.

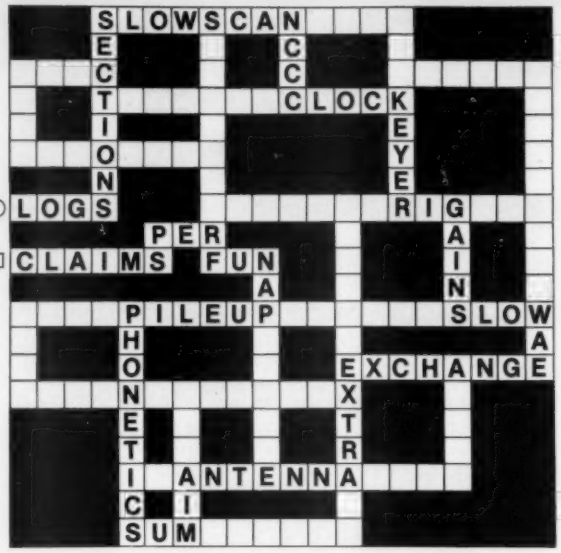


Illustration 2A.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

WORLDWIDE AWARDS DIRECTORY

Award hunting may have become the most favorite pastime of radio amateurs, and the need for a consolidated source of information is apparent. To date, I know of three major sources in which such information is available.

The Worldwide Awards Directory, Volume 1, is now available. It lists over 100 awards, and more will be featured in consecutive volumes to be published at later dates. Its cost, $9.95, should be sent to its publisher, KB0ZP, at 736—39th Street, West Des Moines IA 50265.

INTERNATIONAL DIRECTORY OF AWARDS

This manual features various award programs throughout the world, and segments its contents by continents of the world. Updates to the manual will be issued in the form of a newsletter and may be inserted within the manual. The basic directory is $8.00 or 32 IRCs while the newsletters (published twice annually) will be $4.00 per year. For additional information, contact the directory's publisher, Vance LePierre W5IJU, 2618 McGregor Blvd., Fernandina Beach FL 32034.

THE DX AWARDS GUIDE

The third and probably the most complete source of information is a series of volumes made available by Chuck Ellis of Ames, Iowa. This directory not only details each award program in detail but also provides a very fine facsimile of the award applications. I've utilized its contents numerous times while filing for various parchments and believe me, the work that Chuck put in his publication has cut processing time dramatically. I am positive that the various award sponsors, as well, are appreciative of the effort of providing a uniform application. There is nothing more cumbersome than trying to sort through various application formats all submitted for the same award.

The DX Awards Guide is featured in great detail on page 128 of the July, 1981, edition of this

magazine.

ISLAND DX AWARD

Of all the DX awards being offered these days, one of the newest and fastest-growing awards programs is that of the Island DX Award: Sponsored by the Whidbey Island DX Club, available to licensed amateurs and shortwave listening stations worldwide, awards are issued for 2 × SSB, 2 × CW, 2 × RTTY, and 2 × SSTV, as well as mixed and single-band accomplishments.

Fifty (50) IDX islands as they appear in the IDX Island listing are required for the basic award. Recognition is given for contacts made in increments of 50 islands, up to and including the maximum number of islands possible. All DXCC countries which are bona-fide "islands" are the only qualifying contacts. See the IDX listing in this column.

To apply for the IDX Award, prepare a list of contacts in *prefix order.* Include the call of the station worked, IDX island name, band, mode, date, and GMT. Please *number your contacts* 1 through 50, etc. *Do not send QSL cards!* Have your list of islands verified by at least two amateurs or a local radio club official. Confirmation of each contact must be in the applicant's possession and confirmed by verifying signatures.

Send your verified list of contacts with $4.00 (US funds only) and a large self-addressed, stamped envelope (3½" × 9") to the following address. (Foreign stations may substitute the fee by enclosing twelve IRCs.) Whidbey Island DX Club, 2665 North Busby Road, Oak Harbor WA 98277. Rules governing this awards program are reviewed annually in September. Please enclose an SASE with any inquiries regarding the IDX Awards program.

A3	HKØ (Bajo)	S9,CR5	VS6
A9X	HKØ (Malp)	SV (Crete)	VS9 (See 8Q)
BV	HKØ (San An)	SV (Dodecanese)	VS9K
C2	IS	T2,VR8	VU7 (Andaman)
C6	J3,VP2G	TF	VU7 (Laccadive)
CEØA	JA-JR-KA	TI9	XF4
CEØX	JD,KA1 (Mina)	UA1,UK1 (Franz Jo)	XP
CEØZ	JD,KA1 (Ogasa)	VE1 (Sable)	YB,YC,YD
CO,CM,KG4	JD,7J1 (Okino)	VE1 (St. Paul)	YJ
CT2	JW	VK (Lord Howe)	YVØ
CT3	JX	VK9 (Willis)	ZD7
D4	KG4 (See CO)	VK9 (Christmas)	ZD8
D6	KH1,KB (Baker)	VK9 (Cocos)	ZD9
DU	KH2,KG6 (Guam)	VK9 (Mellish)	ZF
EA6	KH3,KJ	VK9 (Norfolk)	ZK1 (North)
EA8	KH4,KM	VK9 (Heard)	ZK1 (South)
EI, GI	KH5K,KP6 (King)	VK9 (Macquarie)	ZK2
FB8W	KH5,KP6 (Palmy)	VP2A	ZL
FB8X	KH6,WH6,AH6,NH6	VP2D	ZL (Auck-Camp)
FB8Z	KH6,KH7 (Kure)	VP2E	ZL (Chatham)
FC	KH8,KS6	VP2G (See J3)	ZL (Kermadec)
FG (Gaud)	KH9,KW	VP2K	ZM7
FG,FS	KHØ,KH2,KG6 (Mari)	VP2L	ZS2 (Marion)
FH8	KC6 (West)	VP2M	1S
FK	KC6 (East)	VP2S	3B6,3B7
FM	KP (Desoth)	VP2V	3B8
FO (Clip)	KP1 (Navassa)	VP5	3B9
FO	KP2,KV	VP8 (Falkland)	3CØ
FP	KP3,KS4,HKØ (Ran-Ser)	VP8,LU (Ork)	3D2
FR (Glor)	KP4,NP4	VP8,LU (Geo)	3Y
FR (Juan)	KX	VP8,LU (Shet)	4S
FR (Reun)	OHØ	VP8,LU (Sand)	5B,ZC
FR (Trom)	OJØ	VP9	5R
FW	OX,XP	VQ9	5W
G,GM,GW	OY	VR1 (Br. Phoenix)	6Y
GC,GU	P29	VR1 (Gilbert)	8P
GC,GJ	PJ (Neth Ant)	VR3	8Q,VS9
GD	PJ (St. Martin)	VR4 (See H4)	9H
GI,EI	PYØ (Fernando)	VR6	9M6,9M8 (See VS5)
H4,VR4	PYØ (Peter & Paul)	VR7	9V
HC8	PYØ (Trinidade)	VR8 (See T2)	9Y
HH,HI	S7	VS5,9M6,9M8	

Island DX Listing. The IDX Award program depicts DXCC countries which are bona-fide "islands" as recognized by the National Geographic Society. First criterion, however: They must be a DXCC country as stated on the ARRL DX Countries List. Any qualifying DXCC countries either omitted from this list by error or those which have been recognized for DXCC after the release of this listing will be added to the IDX List when it is printed next.

THE CERTIFICATE HUNTERS CLUB

Thanks to Scott Douglas KB7SB, who is the Western States County Award Manager for CHC, we are able to bring to you an extravagant series of operating awards which will obviously win the approval of every county hunter in the world!

Washington State Award

Class D requires 10 to 15 counties; Class C requires 15 to 20 counties; Class B requires 20 to 30 counties; Class A requires 30 to 43 counties; Class AA requires all 44 counties to be worked.

Oregon State Award

Class C requires 10 to 15 counties; Class B requires 20 to 25 counties; Class A requires 30 to 35 counties; Class AA requires all 36 counties to be worked.

California State Award

Class D requires 20 to 28 counties; Class C requires 30 to 38 counties; Class B requires 40

IDX AWARD RECIPIENTS

Over the months, many letters have been received requesting a published list of those stations that have qualified for the IDX Award. In callsign order, here are the IDX recipients. Is your call on this honor roll?

US Stations

W1AGA
N1AHN
WB1BVQ
WB1DQC
WA1GTQ
W1HR
WA1SMI
W1TEE
K1TH
W1WKP
N2AWM
N2BQL
KA2EAO
WB2FFY
N2GG
W2KI
AF2L
KE2M
KF2O
WB2QLO
WA2SRM
KB2TY
WA2VJL
KJ2W
W2XQ
WA2YEX
W2-6893 (SWL)
N3AKX
K3FN
W3HRD
K3LUE
WA3PMI/7
AC3Q
K3VY
N4AKO
WD4DVZ
KE4E
KS4G
WD4IHV
KB4JA
K4JYD
K4LQ
KA4LXZ
WA4QZX
WB4UBD
N4XC
KB5AC
KA5ACC
WD5CDR
N5CID
KA5CTZ
KO5D
K5HT
KB5OU
WB5TZO
KB5WQ
AD5X
N6AFN
WD6AQJ
WD6BNH
WB6CDM/7
WA6CUP
WD6FDN
WA6FDX
W6JGT
W6ORD
WA6PJR
WA6QDR
WA6SLO
WA6VJP
WB7AEX
N7AKQ
WB7BFK
K7CU
WDX7DER (SWL)
K7EFB
WA7GVM
NL7J
KL7JC
WA7JUJ
W7KTI
W7KVV
WB7QEP
WB7RFB
WB7ROE
WB7RUV
W7ULC
WB7VHA
WA7YBN
K7YY
K7ZR
KB8CU
K8EJN
K8IQB
WD8IXV
KD8M
WD8MOV
W8NK
WD8QEO
WD8QOM
N9AII
N9BA
N9BAF
K9BIL
W9BM
K9BQL
WD9HWY
WB9JBH
KB9JJ
WB9NOV
KB9QZ
WB9RNF
K9TI
KB9TO
WB9UIA
WB9UKS
K9UR
WB9VGJ
WB9WFZ
WA9WGJ
AE9X
N0AMI
N0BKY
K0DEQ
KB0OE
WB0OMY/6
K0SI
KB0SY
K0UKO
W0YBV

DX Stations

DA1MP
DA1MV
DF7QD
DF9ZP
DJ2UU
DJ0SL
EA6DE
F6DUK
GU5CIA
HC2RG
IC8OGS
I2GXS
I8INW
I8KDB
I8KNT
I8YRK
I8XTX
I0MWI
JA1SXH
JH1XUP
JI1NOY
JR1EBL
JA4ESR
KH6JWK
KP4AE
LU1BAR/W3
OE1WPA
S83T
VE1BWP
VE3BXY
VE3JGT
VE3-9094 (SWL)
VE5ADA
VK2NHV
VK4FS
VK6YL
VP2MO
6Y5DA
9V1UK

to 48 counties; Class A requires 48 to 57 counties; Class AA requires all 58 counties to be worked.

Arizona State Award

Class C requires 5 counties; Class B requires 8 counties; Class A requires 10 counties; Class AA requires 13 counties to be worked.

Nevada State Award

Class C requires 8 to 10 counties; Class B requires 10 to 15 counties; Class A requires 15 to 17 counties to be worked.

Utah State

Class C requires 7 to 10 counties; Class B requires 18 to 24 counties; Class A requires 22 to 29 counties to be worked.

Wyoming State

Class C requires 7 to 10 counties; Class B requires 15 to 20 counties; Class A requires 20 to 23 counties to be worked.

Idaho State

Class C requires 15 to 20 counties; Class B requires 20 to 30 counties; Class A requires 30 to 43 counties; Class AA requires 44 counties to be worked.

Montana State

Class D requires 15 to 20 counties; Class C requires 20 to 30 counties; Class B requires 30 to 40 counties; Class A requires 40 to 55 counties; Class AA requires 56 counties to be worked.

Alaska State

Issued by actual counties contacted, this award may be obtained for two or more counties confirmed.

Hawaii State

Issued by actual counties contacted, this award may be obtained for two or more counties confirmed.

Rules:

1) Awards are available to licensed amateurs and SWLs (on a heard basis).
2) Do not send QSL cards. A list showing full details of the contacts, signed by your local club official or two licensed amateurs, should be submitted.
3) Certificates will be endorsed for various bands and modes as requested, providing such request accompanies application and necessary listings are made.
4) Award Fee is $3.00 worldwide.
5) Endorsements after original application are $1.00.
6) Send application to Awards Manager, Scott R. Douglas, Jr. KB7SB, PO Box 46032, Los Angeles CA 90046, USA.

CHC AWARD SERIES

Worked USA Award

Districts: Issued for contact with all US call districts 1 through 0.

States: Issued for the total states worked.

Capitals: Issued for the total of capitals of states worked.

Prefixes: Issued for the total number of US prefixes worked.

There is no fee for these awards and they are available to licensed amateurs and SWLs worldwide. A USA SASE is required; worldwide, 3 IRCs are required along with an SAE.

Presidents Award

Issued for the total number of cities worked bearing the last names of past presidents. There is no fee. Same rules as Worked USA Award.

State Cities

Issued for the total number of cities worked. Awards are issued by state (all 6th & 7th district callsigns). There is no fee for this award but same rules as USA Award.

These awards are being issued for a limited time only. Should further information be desired, please contact Awards Manager, Scott R. Douglas, Jr. KB7SB, PO Box 46032, Los Angeles CA 90046, USA.

WORK THE CARIBBEAN AWARD

This basic award is issued for confirmed contact with 20 of the island countries listed below. Endorsement seals are issued

DUE TO A LACK OF PHOTOGRAPHIC CONTRAST BETWEEN TEXT AND BACKGROUND, THIS PAGE DID NOT REPRODUCE WELL.

OPERATING ACHIEVEMENT AWARD
C D C A
This is to Certify that
has submitted GCR proof of having contacted CALIFORNIA (DOUBLE) COUNTIES in numbers and with CLASS as indicated below, and with endorsements for ADMB 'M' as separately shown
AWARD CLASS
AA A B C D
58 48 48/40 38/30 28/20
ADMB 'M' endorsements
CALIFORNIA

in increments of 5 countries each. A Gold Seal plaque can be issued for 30 or more confirmations at a cost of $18.95 in US funds or 95 IRCs. SWLs may apply on a heard basis.

Send your verified application and $3.50 or 18 IRCs to the Awards Manager. Do not forward QSL cards because you may have your QSL cards and claimed contacts verified by two amateurs or a local radio club official.

Endorsements will be issued for any mode, band, or power level requested as long as the request is made at the time of initial application. Future endorsements will cost $1.00 US funds plus an SASE.

Forward your application to Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

Caribbean Country Prefixes

C6, CO/CM, CO4, FG, FS, FM, HH, HI, HK0 (Bajo Nuevo), HK0 (San Andreas), HK0 (Serrana Bank), HR0, J3/VP2G, J6/VP2L, J7/VP2L, KC4/KP1, KG4, KP4/NP4/WP4, KP4 (Desecheo Island), KP3, KP2/KV4, PJ (Netherland Antilles), PJ (St. Maarten, Saba, St. Eustatius), VP2A, VP2K, VP2E, VP2M, VP2S, VP2V, VP5, VP9, YV (Margarita Island), YV0 (Aves Island), ZF, 6Y, 8P, and 9Y.

WORK THE PACIFIC AWARD

This award should not be mistaken for the famous WAP award which has been offered for years out of New Zealand. This particular award featured this month is sponsored by the Certificate Hunters Club (CHC) and its Manager, Scott Douglas KB7SB.

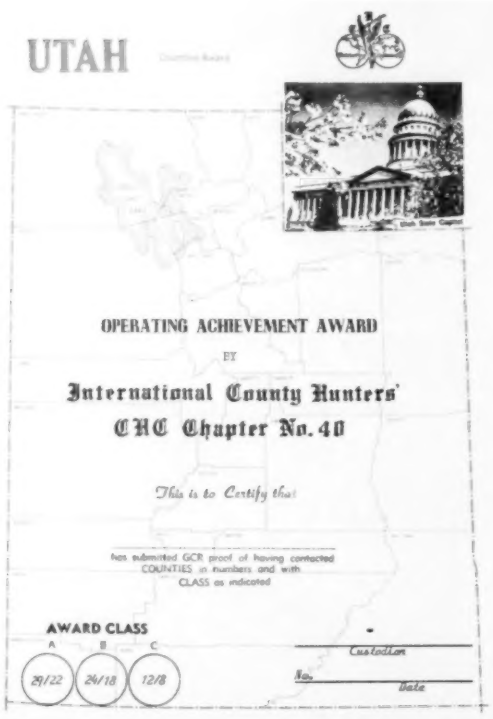
The basic Worked All Pacific Award is issued for 30 confirmed country contacts and is available to any licensed amateur operator or shortwave listener. Endorsement seals are offered in increments of 5 countries. A Gold Seal Plaque can be issued for 50 or more countries worked in the Pacific region if desired. Cost of the plaque will be $18 US dollars or 95 IRCs.

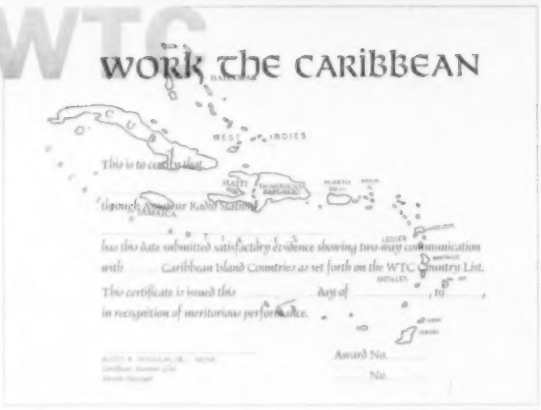
Endorsements for any band, mode, or power will be recognized if such recognition is requested at the time of application.

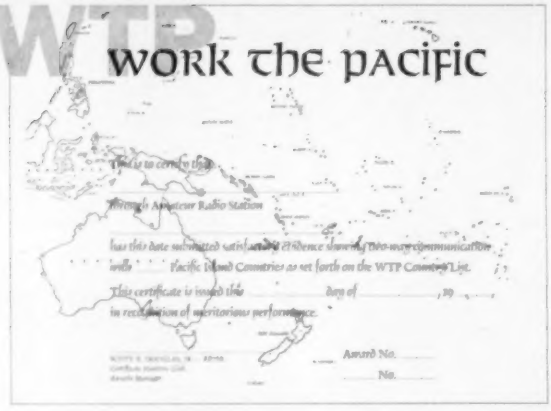
To apply, have your list of confirmed contacts verified by at least two amateurs and have it sent with $3.50 in US funds or 18 IRCs to the Awards Manager, Scott Doulgas KB7SB, PO Box 46032, Los Angeles CA 90046.

Pacific Country Prefixes

A3, BV, C2, CE0A, CE0X, CE0Z, DU, FK, FO (Clipperton), FO (French Polynesia), FW, H44/VR4, HC8, HK0 (Malpelo Island), JD1/KA1 (Minami Tori-




WTC
WORK THE CARIBBEAN
WEST INDIES
This is to certify that
through Amateur Radio Station
has this date submitted satisfactory evidence showing two-way communication
with Caribbean Island Countries as set forth on the WTC Country List.
This certificate is issued this day of , 19
in recognition of meritorious performance.
Award No.
No.


WTP
WORK THE PACIFIC
This is to certify that
through Amateur Radio Station
has this date submitted satisfactory evidence showing two-way communication
with Pacific Island Countries as set forth on the WTP Country List.
This certificate is issued this day of , 19
in recognition of meritorious performance.
Award No.
No.

shima), JD1/KA1 (Ogasawara), KB1/KH1, KC6 (Eastern Caroline Islands), KC6 (Western Caroline Islands), KC6 (Valu), KH2, KH0, KH6, KH7, KH3, KH4, KH5K, KH5, KH8, P2, T2/VR8, T3/VR1 (Central, West, and East Kiribati separately), TI9, VK7, VK, VK2, VK9 (Willis), VK9 (Christmas), VK9 (Cocos Keeling), VK9 (Mellish), VK9 (Norfolk), VK0 (Heard), VK0 (Macquarie), VR6, VS5, XF4, BY/YC, YJ, ZK1 (North Cook), ZK1 (South Cook), ZK2, ZL, ZL (Auckland Island), ZL (Campbell), ZL (Chatham), ZL (Kermadec), ZM7, 3D2 and 5W, 9M2, and 9M6.

SPRUCE KNOB

The Parkersburg Amateur Radio Klub of West Virginia will be holding an in-state DXpedition from the top of Spruce Knob, West Virginia. Spruce Knob is the highest mountain point in West Virginia. Elevation is 4862' and it is located in Randolph county, for you county hunters.

The expedition will be on October 3 and 4, starting at 1500 universal time. Station call will be N8CDD. Planned frequencies are: ±3.935, 7.235, 14.335, 21.360, and 28.535; on 2 meters: 144.200, 144.190, SSB, 144.110, CW; on 6 meters: frequencies are 52.150, SSB, 52.525, FM; for CW on HF bands, 10 kHz up on all Novice bands. For special QSL, send an SASE to N8CDD, 902 23rd Street, Vienna W VA 26105.

POPULATION CENTER

The population center of the US as determined by the 1980 census will be commemorated by special event station KA0IAR from 1700 GMT October 10 until 1700 GMT October 11, by the Jefferson County ARC in De-Soto, Missouri. Approximate frequencies used will be 25 kHz up from bottom edge of the General portions of 10, 15, 20, and 40, as well as the center of the Novice portions. For a certificate, send QSL and a large SASE to KA0IAR, 3009 High Ridge Blvd., High Ridge MO 63049.

SUNBELT EXPOSITION

The Colquitt County Ham Radio Society will be operating club station WD4KOW from the site of the fourth annual Sunbelt Agricultural Exposition on October 13-15, 1981. The hours of operation will be 0900 to 1600 EDST each day.

This annual Sunbelt Expo is held each year at Spence Field Air Base, located near Moultrie, Georgia, and is the largest agricultural show in the South. This event draws over 200,000 visitors from all over the United States and foreign countries.

Operations will be mostly on 40 and 20 meters around 7.250 and 14.300 MHz, with some operations in the other HF bands. The members also will be listening for visiting hams on the local repeater, 146.19/.79. Visiting hams are invited to visit the amateur booth at the Expo and operate the station.

A special QSL card is available for those making contact during this event. Contact Joel Goings AA4P, Secretary, Colquitt County Ham Radio Society, PO Box 813, Moultrie GA 31768, for more information.

73 MAGAZINE AWARDS PROGRAM

Work The World Award

76 VP2MO	83 W6JQT	90 WB5TZO
77 HK0EHM	84 WB2TKD	91 WB7VHA
78 WA2SRM	85 W9BM	92 VK2DEJ
79 KA5CTZ	86 WD6EEQ	93 WB1BVQ
80 DF7QD	87 KB7SC	94 KF2X
81 WA2YEX	88 KA2EAO	95 OE1-109976
82 N5BBO	89 K8IQB	96 OE8MOK

North American Award

114 WD4BLU	128 WD6EEQ	142 WB2YMW
115 WB0OMY/6	129 N7AHQ	143 AK1H
116 VK4FS	130 W0OLL	144 WB1BVQ
117 DJ0SL	131 KA9HRI	145 VK2DEJ
118 VE3DIJ	132 WB7VHA	146 DA1PN
119 HK0EHM	133 WB5LBR	147 KF2X
120 VP2MO	134 KA9ERX	148 OE1-109976
121 DF7QD	135 KB7SC	149 W1SIX
122 KA3DBN	136 WA2MCE	150 KA3GGP
123 W6JQT	137 K7DBV	151 KJ0WQ
124 WB0BWY	138 K8IQB	152 OE8MOK
125 N5BBO	139 8P6OV	153 VE1BWP
126 WB2TKD	140 KA1CLV	
127 W9BM	141 WB5TZO	

South American Award

103 DF7QD	115 WB7VHA	127 KC4YY
104 VP2MO	116 WB5LBR	128 WB1BVQ
105 HK0EHM	117 KA9ERX	129 VK2DEJ
106 DJ0SL	118 N7AHQ	130 DK5WJ
107 KA3DBN	119 KB7SC	131 DA1PN
108 N5BBO	120 KB8WJ	132 KF2X
109 WB0BWY	121 VE3DIJ	133 OE1-109976
110 W6JQT	122 8P6OV	134 DJ0WQ
111 ZE2KA	123 K8IQB	135 OE8MOK
112 WB2TKD	124 AK1H	136 VE1BWP
113 W9BM	125 WB2YMW	
114 W0OLL	126 WB5TZO	

DUE TO A LACK OF PHOTOGRAPHIC CONTRAST BETWEEN TEXT AND BACKGROUND, THIS PAGE DID NOT REPRODUCE WELL.

European Award

131 SV1GJ
132 DJ0SL
133 VE3DIJ
134 HK0EHM
135 VP2MO
136 DF7QD
137 KA1CFQ
138 XE2KA
139 N5BBO
140 WB0BWY
141 W6JQT
142 W9BM
143 WB2TKD
144 WD6EEQ
145 WB9JBH
146 KA7COI
147 WB5LBR
148 KA8RD
149 W0CJG
150 WA2SHW
151 8P6OV
152 KB7SC
153 WA2MCE
154 K8IQB
155 KA2EAO
156 W1SIX
157 KA1CLV
158 KB8WJ
159 AK1H
160 WB2YMW
161 WB5TZO
162 WB7VHA
163 WB6SZZ
164 K7DBV
165 N0ASV
166 WB1BVQ
167 VK2DEJ
168 DA1PN
169 DU1EFZ
170 KF2X
171 OE1-109976
172 DJ0WQ
173 KA7GFI
174 OE8MOK
175 VE1BWF

Oceanic Award

85 WA2SRM
86 DF7QD
87 VP2MO
88 HK0EHM
89 VK4FS
90 WA2YEX
91 N5BBO
92 W6JQT
93 WB2TKD
94 ZL2BAO
95 W9BM
96 WB7VHA
97 WA2LYF
98 KC7SC
99 KA2EAO
100 K8IQB
101 WB5TZO
102 WB1BVQ
103 VK2DEJ
104 DU1EFZ
105 KF2X
106 OE1-109976
107 OE8MOK

African Award

89 DJ0SL
90 HK0EHM
91 VP2MO
92 DF7QD
93 KA3DBN
94 W6JQT
95 N5BBO
96 WB0BWY
97 WB2TKD
98 WD6EEQ
99 KA9ERX
100 WB5LBR
101 WA2LYF
102 W9BM
103 KB7SC
104 DK5WJ
105 K8IQB
106 KA2EAO
107 AK1H
108 WB2YMW
109 WB5TZO
110 WBVHA
111 VK2DEJ
112 WB1BVQ
113 DA1PN
114 DU1EFZ
115 KF2X
116 DJ0WQ
117 OE1-109976
118 OE8MOK
119 VE1BWP

Asian Award

84 DF7QD
85 VP2MO
86 HK0EHM
87 DJ0SL
88 KA5CTZ
89 W6JQT
90 N5BBO
91 WB2TKD
92 WD6EEQ
93 W9BM
94 KB7SC
95 KA2EAO
96 K8IQB
97 WB5TZO
98 WB7VHA
99 DA1PN
100 WB1BVQ
101 VK2DEJ
102 DU1EFZ
103 KF2X
104 OE1-109976
105 DJ0WQ
106 OE8MOK
107 VE1BWP
108 SV1GJ

Worked All USA

6 Meters

1 WB0ZKG
2 K6PHE
3 N4BJJ
4 KA5DDE
5 WB5SND
6 K3HFV
7 N4QH

10 Meters

1 KL7IEN
2 W5ZKJ
3 VE1BVD
4 JH8DSC
5 VK7NBT
6 VE1BWP
7 N4QH

15 Meters

1 WD5DRB
2 WA0CEL
3 KA6ACO
4 WB6CDM
5 KA4IFF
6 WB9UKS
7 N4QH

20 Meters

1 WA9BBX
2 WA9WGJ
3 K1TH
4 KB8JF
5 WD0EPE
6 WB9UKS
7 VK6YL
8 N8BDI
9 N4QH
10 KA0INF

40 Meters

1 WA2SRM
2 N8AZD
3 WD4DBJ
4 WD0BOS
5 N5AHZ
6 N4QH

80 Meters

1 KA0AZQ
2 WD0BOS
3 KA5AOP
4 KS4B
5 WB9UKS
6 KB5FN
7 WA0RVK
8 N4QH

160 Meters

1 KC8P

Worked All USA

All Band

42 N4CXK
43 KA8GXN
44 N6BXT
45 WA4ZLZ
46 W9BM
47 KA7HPP
48 WD6EEQ
49 W0CJG
50 N5ACU
51 NL7J
52 KA4ITQ
53 WB9UIA

73 DX Country Club

2 × SSB

54 W5SGT
55 W9BM
56 DF7QD
57 WB7RUV
58 N7AKQ
59 WB5LBR
60 VK6YL
61 KF2X
62 VK4FS
63 K9PSN
64 K3KJZ
65 K3LUE
66 WB1BVQ
67 WB2YMW
68 AK1H
69 WD4DVZ
70 DA1PN
71 VK2DEJ
72 VK2BQN
73 VE1BWP
74 OE8MOK

Mixed Mode

22 WB5LBR
23 WD6EEQ
24 NL7J

2 × CW

9 WB9UIA
12 KA2EAO
10 WB9UIA
11 VE1BWP

Century Cities Award

19 W9BM
22 WB9UIA
20 K7DBV
21 VK6YL

Q5 Award of Excellence

44 KA2GTT
45 KA4JVN
46 KA4KST
47 VK3VEU
48 KA1CFQ
49 KA9CWW
50 W9BM
51 ZL2LQ
52 KA2GMT
53 KA0FVG
54 KA0INE
55 KA0INF
56 N5AUB
57 WB6SZZ
58 KA0KCM
59 KB9PN
60 KA6AHL

More award winners will be listed next month. Full details of the *73* Awards Program can be found in the September, 1981, issue of this magazine. Why not become part of the fastest-growing awards program around!

SOCIAL EVENTS

HOUSTON TX
OCT 2-4

The Houston ComVention 81 will be held on October 2-4, 1981, at the Astrodomain, Houston TX. Features will include an indoor flea market, a Friday night equipment auction, computer exhibits and forums, technical sessions, and DX/Contest meetings with Father Moran 9N1MM. Family activites are planned and the ladies will have a full schedule. Registration is $7.00, the banquet is $18.00, the Johnson Space Center tour is $6.00, and flea market spaces are $6.00 each. For full details, contact HHC, Inc., Box 79252, Houston TX 77024, or phone (713)-481-4586.

CLEARWATER FL
OCT 3-4

The Florida Gulf Coast Amateur Radio Council will holds its annual convention in conjunction with the ARRL South Florida Section Convention on October 3-4, 1981, at the Sheraton Sand Key, Clearwater FL. Registration is $4.00 and children under 12 years old will be admitted free. There will be a QCWA-sponsored luncheon at noon on Saturday, a poolside luau Saturday night, and a fashion show and luncheon on Sunday. Swap tables are $10.00 for the weekend, luncheon tickets are $6.00, and luau tickets are $12.00. Features will include forums, demonstrations, meetings, exhibits for the amateur as well as for XYLs, and a limited swap area. Talk-in on 146.37/.97. For further information or reservations, write FGCARC, PO Box 157, Clearwater FL 33517, or phone Jan KA4ELA at (813)-544-6734.

ROCK HILL SC
OCT 4

The York County Amateur Radio Society will hold its 30th annual hamfest on Sunday, October 4, 1981, at Joslin Park in Rock Hill SC. For additional information and pre-registration, write YCARS, PO Box 4141 CRS, Rock Hill SC 29730.

REVERE MA
OCT 4

The 19-79 Repeater Association of Chelsea MA will hold its annual flea market on Sunday, October 4, 1981, from 11:00 am to 4:00 pm (sellers will be admitted at 10:00 am) at the Beachmont VFW Post, 150 Bennington Street, Revere MA. Admission is $1.00. Sellers' tables are $6.00 in advance and $8.00 at the door, if still available. Talk-in on .19/.79 and .52. For table reservations, send a check to 19-79 Repeater Association, PO Box 171, Chelsea MA 02150.

YONKERS NY
OCT 4

The Yonkers Amateur Radio Club will hold its electronics flea market on Sunday, October 4, 9:00 am to 4:00 pm, at the parking lots of Loral Electronics on Fullerton Avenue in Yonkers, NY. Activities include prizes, an auction, and live demonstrations of computers, satellite TV, hi-fi equipment, and more. Admission is $2.00; sellers' space is $5.00 (bring your own tables). Talk-in on 146.865, 146.910, and CB channel 4. For advanced registration, contact Otto Supliski WB2SLQ, 52 Hayward Street, Yonkers NY 10704. For more info, call (914)-969-1053.

ROME GA
OCT 4

The Coosa Valley Amateur Radio Club will host the annual Rome, Georgia, Hamfest on Sunday, October 4, 1981, at the Rome Fairgrounds. Gates open at 7:00 am, with the main prize drawing at 3:00 pm. Admission is $1.00 and additional prize tickets will be available. Activities include dealer displays, boneyard and flea market, ladies' bingo, and hot, homemade barbeque and Brunswick stew. Top prizes are an Icom IC-260A 2-meter SSB/FM/CW mobile transceiver, an IC-2A 2-meter handie-talkie, and a Trionix full-range frequency counter. You do not have to be present to win the first prize. There will be hourly door-prize drawings plus prizes for the ladies and children. Talk-in on 147.30/.90. For more information, call Cathy Strickland WA4YSV at (404)-235-2311.

SCOTTSDALE AZ
OCT 9-11

The Scottsdale Amateur Radio Club will hold the 1981 Southwestern Division ARRL Regional Convention on October 9-11, 1981, in Scottsdale AZ. There will be major exhibitors and thousands of dollars in prizes. On Saturday, October 10th, a western-style steak dinner will be served and Senator Barry M. Goldwater K7UGA will be the special dinner speaker. Tours of the Senator's "shack" will be conducted also on Saturday. For more information, contact SARC Convention Committee, PO Box 3073, Scottsdale AZ 85257.

MEMPHIS TN
OCT 10-11

The Mid-South Amateur Radio Association, the Memphis VHF Club, the Raleigh ARA, and the Delta ARC will hold the Memphis Hamfest on October 10-11, 1981, in the Youth Building at the Memphis Fairgrounds, Memphis TN. Admission is $3.00 and children under 14 will be admitted free. The hours will be from 8:00 am to 4:00 pm on Saturday and 8:00 am to 2:30 pm on Sunday. Features will include a large indoor and outdoor flea market, on-site trailer hookups, ladies' activities, many forums, and (on Saturday night) a party/dance with snacks. Deadline for Friday night setups for dealers and the flea market is 9:00 pm. Talk-in on .34/.94 and .52. For advance reservations and further details, write Memphis Hamfest, 28 North Cooper, Memphis TN 38104, or phone Clayton Elam K4FZJ at (901)-274-4418 (days) or (901)-743-6714 (nights), or Howard Smith WD5DVB at (901)-372-9618.

ASHEVILLE NC
OCT 10

The Western Carolina Amateur Radio Society, Inc., will hold its 6th annual Asheville Autumnfest on Saturday, October 10,

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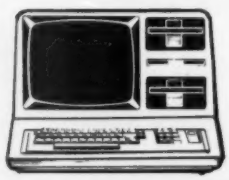

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When sideband got started, it was moved along by the many pioneering articles in *73*. In the 60s it was solid state, with several times as many articles on the subject than in all the other magazines combined. When repeaters and FM got going about ten years ago there were over five times as many articles on the subject published in *73* as in all other ham magazines combined . . . and you can see what changes that brought to hamming. Now we're looking at exciting developments such as narrow band sideband for repeaters . . . which might give us six times as many repeaters in our present bands. We're looking at automatic identification systems which may make it possible for us to read out the call letters of any station tuned in . . . and even the development of self-tuning receivers.

Will stereo double sideband techniques make it possible to have up to 30 times as many stations within a given HF band as is now possible? Hams will be experimenting and reporting on these developments in *73*. *73* is an encyclopedia of hamming . . . present and future . . . and just a bit of the past, too.

Without the endless fillers on station activities and club news, *73* is able to publish far more information . . . valuable information . . . on hamming and ham equipment.

You may or may not be a pioneer, but you certainly will want to keep up with what is happening and what the new rigs are going to be like. And, frankly, your support of *73* is needed to keep this type of information coming.

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1981, at the Asheville Civic Center, Asheville NC. Admission is $3.00 in advance and $3.50 at the door. Featured will be dealers, an ARRL booth, and a McElroy memorial CW competition. Prizes include an HF transceiver, a 2-meter transceiver, and many other prizes and door prizes. Talk-in on .31/.91, .16/.76, and .52. For more information, contact WCARS, Box 1488, Asheville NC 28802.

WAUKESHA WI
OCT 11

The KMRA Hamfest '81 will be held on Sunday, October 11, at the Waukesha Exposition Center, Hwy. FT, Waukesha WI. Tickets are $2.00 in advance; $3.00 at the gate. Talk-in on .52. For more info, or advance tickets, write KMRA Hamfest '81, 315 Morey Street, Waukesha WI 53186.

BEDFORD IN
OCT 11

The Hoosier Hills Ham Club W9QYQ will hold its annual hamfest on Sunday, October 11, 1981, at the Lawrence County 4-H fairgrounds, located just south of Bedford IN. Admission is $3.00. There will be refreshments, a free flea market, vendor displays/sales, free camping, and prizes (including a grand prize of an Azden PCS-3000 and a raffle prize of a TRS-80 Model III 4K L1 computer). Talk-in on 146.13/.73. For advance registrations and further information, contact HHHC, PO Box 891, Bedford IN 47421.

PARAMUS NJ
OCT 11

The Bergen ARA will hold a ham Swap 'n Sell on October 11, 1981, at Bergen Community College, Paramus NJ. Seller's admission is $3.00. There will be tailgating only; bring your own table. There will be thousands of spaces available. Buyers will be admitted free. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

BALTIMORE MD
OCT 11

The Columbia Amateur Radio Association will hold its 5th annual hamfest at the Howard County Fairgrounds (15 miles west of Baltimore, just off I-70 on Rt. 144, 1 mile west of Rt. 144, 1 mile west of Rt. 32) on Sunday, October 11, 1981, at 8:00 am. Admission is $3.00 and tailgating and tables are $6.00. Food and prizes will be available. Talk-in on 147.735/.135 and 146.52/.52. For table reservations and information, write Dennis Parra, 6955 Spinning Seed, Columbia MD 21045.

BIG RAPIDS MI
OCT 17

The Big Rapids Area Amateur Radio Club will hold a fox hunt on Saturday, October 17, 1981, starting at Hemlock Park in Big Rapids MI. Registration is from 8:00 am to 10:00 am. Hunt starts at 10:00 am sharp, rain or shine, on on 146.64. Families, picnics, trunk-sale horsetraders, welcome. $3.50 registration per carload. Information packets sent to advance registrants. Prizes will be awarded and food will be available. Talk-in on .52. For further information, contact Bruce L. Werner WB8TVD, Box 1073, Big Rapids MI 49307.

KALAMAZOO MI
OCT 17

The 27th annual VHF Conference will be held on Saturday, October 17, 1981, at Kohrman Hall, at Western Michigan University, Kalamazoo MI, from 8:30 am through the awards dinner at 6:30 pm. VHF topics will include Design of Low Noise GaAs FET Preamps, An Overview of Packet Networking, and five others. For more information, write Dr. Glade Wilcox W9UHF, VHF Conference Chairman, Western Michigan University, Kalamazoo MI 49008.

IRWIN PA
OCT 17

The Irwin Area Amateur Radio Association will hold its swap and shop on Saturday, October 17, 1981, at the Circleville VFD, Robbin's Station Road, in Irwin PA, just off US 30, 3 miles west of the Pennsylvania Turnpike (exit 7). There will be plenty of indoor and outdoor space available. Features include a flea market, prizes, vendors, and food. Talk-in on 146.925/.325 and .52. For more information, write

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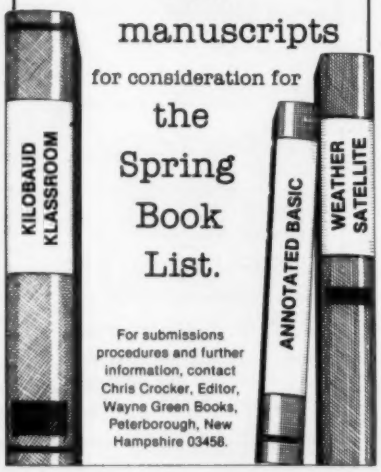

For submissions procedures and further information, contact Chris Crocker, Editor, Wayne Green Books, Peterborough, New Hampshire 03458.

Bill Stash WA3AOQ, 421 Dailey Drive, N. Huntingdon PA 15642.

KENNER LA
OCT 17-18

The Jefferson Amateur Radio Club will hold Amacon '81 on October 17-18, 1981, at the Airport Hilton Inn, 901 Airline Highway, Kenner LA. The FCC will conduct tests for all but the Novice level at Our Lady of Perpetual Help School, 530 Minor Street, Kenner LA starting at noon on Saturday, October 17, 1981. Applicants should bring copies of their licenses to the test. Other features will include an indoor flea market, a full schedule of women's events, and FCC, ARRL, and Army and Navy MARS meetings. Talk-in on 147.69/.09. For more details, call W. D. "Bill" Bushnell, chairman, at (504)-887-5022.

GROTON CT
OCT 24

The SCRAMS and the Tri-City Amateur Radio Clubs of Groton CT will hold an auction on Saturday, October 24, 1981, from 10:00 am to 4:00 pm at St. Mary's Parish Hall, at the intersection of Rtes. 1 and 215, Groton CT. Admission is free. Talk-in on .07/.67 or .34/.94. For further information, write Anne Hibbert WB1GVL, 64 Giant's Neck Road, Niantic CT 06357, or phone (203)-739-4970.

CHATTANOOGA TN
OCT 24-25

Hamfest Chattanooga will be held on October 24-25, 1981, at Chattanooga State Technical Community College, Chattanooga TN. Admission is free. Flea market spaces are $2.00 for one day or $3.00 for both days; prize ticket donations are $1.00 each. Events will include dealer exhibits, a flea market, forums, contests, and ladies' programs. Talk-in on .19/.79 and 3980. For dealer information, write Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404, or call (404)-398-3358.

NEWARK NJ
OCT 24-25

The second annual NJ Microcomputer Show and Flea Market will be held on Saturday and Sunday, October 24-25, 1981, at the Holiday Inn North, Newark Airport, Exit 14 of the NJ Turnpike. Admission to the flea market is $5.00 for sellers and $3.00 for buyers. Admission to both the flea market and the show is $5.00. Saturday hours are 10:00 am to 5:30 pm and Sunday hours are 10:00 am to 3:00 pm. User groups will meet each day and there will be many microcomputer exhibits indoors. For additional information, contact Ken Gordon W2TGH, 3001 Route 27, Franklin Park NJ 08823, or phone (201)-297-2526.

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FRAMINGHAM MA
OCT 25

The Framingham Amateur Radio Association will hold its 6th annual fall flea market on Sunday, October 25, at the Framingham police station drill shed. This is the largest indoor ham flea market in New England! Doors open at 10:00 am (sellers may begin setup at 8:00 am). Admission is $1.00; sellers' cost is $8/table (prior to October 15, $10/table after October 15). Talk-in on .75/.15 and .52 direct. There will be a consignment table (for small items), food, and bargains. For more info, contact Ron Egalka K1YHM, 3 Driscoll Drive, Framingham MA 01701; (617)-877-4520.

MARION OH
OCT 25

The Marion Amateur Radio Club will hold its 7th annual Heart of Ohio Ham Fiesta on Sunday, October 25, 1981, from 0800 to 1600 hours at the Marion County Fairgrounds Coliseum, Marion OH. Featured will be many prizes. Food and a large parking lot will be available. Tickets are $2.00 in advance or $3.00 at the door. Tables are $4.00. Talk-in on 146.52, 147.90/.30, or 223.34/224.94. For additional information, tickets, or tables, contact Paul Kilzer W8GAX, 393 Pole Lane Road, Marion OH 43302.

WHITESTONE NY
OCT 25

The Tu Boro ARC will hold a mini flea market and auction on Sunday, October 25, 1981, from 9:00 am to 4:00 pm at the Odd Fellows Hall, 149-14 14th Avenue, Whitestone NY. Admission is a $1.00 donation. Talk-in on 145.62. For table space and other information, contact either Marty WA2APT at (212)-359-6923, or Ed WB2IBQ at (212)-746-4082 after 7:00 pm.

DORCHESTER ONT CAN
OCT 25

The London Amateur Radio Club will hold its 4th annual Swap 'n Shop flea market on Sunday, October 25, 1981, from 9:00 am to 4:00 pm at Lord Dorchester Secondary School, Dorchester, Ontario. Admission is $2.00 per person with children under 12 admitted free. Tables are $1.00 per table (plus admission) and must be reserved and paid for in advance. Talk-in on 147.78/.18 or 146.52. For additional information, write to Dick Reiber VE3IBV, 417 Regal Drive, London, Ontario N5Y 1J8, Canada.

See List of Advertisers on page 130

LEAKY LINES

Dave Mann K2AGZ
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I have frequently been savaged as a result of my implacable refusal to go along with the fashionable new attitude of detente that has developed between hams and CB operators. Largely inspired by persons who hold both tickets, and aided and abetted by certain business interests in both electronics manufacturing and in the magazine publishing field, this phony and hypocritical fraternalism poses naught but disadvantage for us. We have little to gain, but a great deal to lose.

Why the unnatural alliance? Who needs it?

Don't get me wrong. Our ranks have been strengthened by many who were first exposed to communications as CBers. They worked hard to achieve their qualifications and deserve all the credit in the world, for they had much to overcome. In point of fact, many of these converts to amateur radio came in as a result of their disgust with CB and their realization that nothing could ever change it and make it a viable service; it had been allowed to retrogress for such a long period that it was too far gone. Despite all the best efforts of the few constructive elements within CB ranks, they have never been able to "clean up their act." CB remains, almost 25 years after its inception, an undisciplined, rowdy service, incapable of self-policing. And the licensing authority, the FCC, is apparently unwilling and unable to do anything about the mess.

Typical of what's been going on is an incident reported in the press on the 23rd of June. Three fishermen whose boat capsized in rough seas off Fire Island, N.Y., may have lost their lives because chit-chatting CBers weekending there refused to relinquish an emergency channel. A Coast Guard search for the missing men was abandoned after 21 hours. The proprietor of the marina where the ill-fated *Water Rat* had been berthed said, "It was outrageous! They begged the people to get off the channel, but the idiots went right on talking." A Coast Guard officer said that the problem of people chatting on reserved channels occurs all the time on Citizens Band.

This points up the obvious: If it weren't for the long-term failure of the FCC to insist not only upon mere possession of the applicable regulations, but also upon familiarity with their provisions, there would be greater compliance. How can users be expected to follow rules that they are not required to be conversant with? And how can there be any assurance that they know the rules unless they are required to take an examination which tests their knowledge?

At the very least, the license grant should have been contingent upon a grasp of the radio regulations applicable to the particular service.

But since the FCC has not seen fit to impose such obligations as a prerequisite to licensing, then we, as a conscientious group faced with the necessity of preserving the traditional character of amateur radio as a self-policing service, must oppose all measures which would water down "entrance requirements" and make the acquisition of a ham radio license easy.

I happen to believe that those who are in the forefront of all movements toward detente between the two services have but one purpose in mind: to establish easy ways for unqualified persons to acquire the ham license—code-free licenses, etc. And among the more insidious methods of accomplishing such a sinister goal is the constant effort to legitimize CB in the public mind so that the vast majority of the people will no longer regard the two services as distinct and apart. And I do not believe that there is any doubt that this tactic has succeeded, at least partially.

We had a cookout here recently, and one of our friends brought a lady along. During the course of the afternoon, she glanced at my antenna installation and said to me, "My, you must be a ham operator. My son is also a ham...his numbers are..." And she rattled off one of those Citizens Band callsigns. When I explained that there is a marked difference, her reaction made it abundantly clear that she hadn't any idea that her youngster was not an amateur operator; this was the first she'd heard of it.

I've just learned that Kayla Hale W1EMV/TI5 passed on recently. A former editor of this magazine, Kayla was a very dear friend of long standing and was directly responsible for my association with *73*. A constant member of the 3999 gang, she was highly respected and will be greatly missed by all who knew her.

Mentioning Kayla reminds me that just a few months ago she wrote a letter that was published in the correspondence section in which she complained about deliberate interference during her attempt to resolve a medical emergency. Her husband suddenly took ill, and her efforts to get a phone patch were marred by intentional QRM. I cite this in order to acknowledge that in ham radio we also have our problems and are not free from our own incorrigibles. But I think it is fair to say that such idiots are in the negligible minority and are roundly condemned by the vast majority.

The DX fraternity is divided into two distinct groupings—those who have succeeded in working XZ5A, and those who haven't made contact. Of course there is that little coterie of fortunate persons who are already credited with Burma, and among them there are those who worked Don Miller W9WNV some sixteen years or so ago.

There is great discussion going on concerning the legitimacy of the present operation. Documentation was not issued by the Rangoon government, apparently, but by the State of Kawthoolei. Speculation is running rife and there is great uncertainty about whether the DXCC office in Newington will accept the operation as valid. Those who are holding the QSL are advancing all sorts of arguments in favor of okaying the operation, while those who haven't worked the station tend to express doubts about it. Since I happen to be one of the former, I hope that Newington will accept it as valid.

The problem is that Rangoon seems immovable in its unwillingness to permit amateur activity now and for the foreseeable future. Because of this intransigence, it is impossible to anticipate that there will ever be any operation which might have official sanction of the Burmese central government. Apparently an insurgent group is in control of the State of Kawthoolei, where the present operation is based, and if documents issued by such a provincial government are not going to be deemed valid by the League, there is no chance that anyone who still needs Burma will be able to make it.

But what of the last operation from Burma? Did Don Miller submit documentation? And was such documentation scrutinized carefully in oder to establish validity beyond any question? These are questions that are being asked and deserve answers. Because of repeated irregularities in his various DXpeditions, Miller's operations, though accepted at the time, are now widely suspect. My point is simply that unless Don Miller's Burma operation was properly documented, it is grossly hypocritical for the League to void the legitimacy of the present XZ5A/XZ9A operation. How can DXCC refuse to accept Kawthoolei licensing while it accepts the validity of an operation in which the documentation is widely regarded as spurious?

I think that at the very least, the League should examine the records in order to establish beyond question that the documentation offered by Miller was in order and not fraudulent. I think that the League owes this to the thousands of amateurs all over the world who have exerted their efforts to work the present operation in good faith. Cavalier dismissal on a technical point is acceptable only if the technicality is applied across the board

and with equal weight. Any other course is inequitable and fosters some of us an unfair advantage at the expense of the rest. An advantage, I might add, that can never be overcome as long as the present Rangoon government maintains its adamant opposition toward any and all amateur radio activity. That, I submit, is the intention of the Burmese authorities, and for this reason an examination of the continued inclusion of Burma on the DXCC countries list now becomes appropriate, in my view.

I would also express the view that if it is found that the Rangoon government is not now in a position of administrative control of the State of Kawthoolei, and if it can be shown that all civil, military, political, and economic administrative rule is in the hands of a provincial government, then the ARRL should accept radio licensing documentation issued by Kawthoolei as valid and legitimate.

After all, at the time of the writing of our own Declaration of Independence, our colonies had not yet won their freedom from Britain, yet that document's legitimacy and validity has never been regarded questionable; indeed, it represents a milestone in the fight for human freedom and dignity. We have recognized and continue currently to recognize the validity of insurgent governments which succeed in overthrowing despotic, tyrannical regimes throughout the world. Why should Kawthoolei be an exception? Or, more important still, is it the function of DXCC to grant or withhold recognition when there is a *de facto* government in actual power and control? These are not questions which should be decided arbitrarily by a single individual or group acting on the basis of private initiative.

The major problem is that it is the central government in Rangoon which is the main culprit. It is in Rangoon that the small oligarchy wields the oppressive power which denies our Burmese colleagues the right to operate their stations. In the very act of recognizing the validity of the Kawthoolei documentation, we can demonstrate a strong endorsement of our national commitment to human rights, and at the same time we can reinforce our solidarity with our ham colleagues all over the globe. If we deny the validity of the Kawthoolei operation, we serve notice to restrictive governments that they can limit or outlaw amateur radio without running the risk of the slightest objection.

DX

Yuri Blanarovich VE3BMV
Box 292
Don Mills
Ontario M3C 2S2
Canada

DX CONTESTS

In the months of October and November we have the major contest, what we can call the Olympics of amateur radio: the *CQ* WW DX Contest. It is unquestionably the biggest and best attended contest of them all. The contesters know what to do; they are trying to get the most contacts with the maximum possible number of countries and zones as possible. The DXers usually show up and tune the bands to find the juicy ones or those that they are still missing on their "most-wanted" lists, because there is an opportunity to work something like 150 countries on the weekend.

A number of Contestpeditions show up from the rare spots. For them, this is a clear advantage, because they have a chance to operate from a good geographical location with good propagation, usually around the equator, and possibly from a country that is relatively rare. The more rare the country, the better the chance to get more people to call them and make more contacts.

To illustrate some of the rates achieved in the contest, the VP2KC operator had runs of about 340 QSOs an hour working JAs. Some stations work around 150 countries on the higher bands. So, wouldn't it be easier to work that BY or ZA under circumstances like that?

Where do the lists stand? Down in the mud. So, all in all, it is a great opportunity to improve your operating skills and also watch those big guns to see how they operate. Also, when you have a big gun locally, you can compare what he is hearing and what you are. Maybe you will discover that that antenna can be better (and bigger) than it is.

It is becoming more common to have some "spectators," that is, operators tuning around the contest turmoil and observing the propagation, signals, techniques, etc. One thing that they also do is give a call to a contester or DXer and help him with a point or two. It is a nice gesture, especially to those who are sitting in the not-so-rare countries such as W or VE. Maybe he was the one who gave you that Spratley or Market Reef contact. So, say thank you.

The multi-multi stations are like beacons on the band. They even call when the bands are seemingly dead, because they are stuck on that band anyway. Some interesting things can be observed.

So, all in all, it is a great opportunity to get that rare one, especially for those who are starting up and need to get there quickly. Watch out for the QSL routes—most of the operations have a QSL manager.

QSLING

What is a QSL card? It is a confirmation of an established contact and it is proof and a record of that event (or, better to say, it is supposed to be). There are always the good and bad, and we have that in our hobby, too. Some DXers figured why bother working the guy if they can maybe get that card anyway, or they would do anything to get the card so they can add it to their total and eventually show up on the Honor Roll. Makes one wonder what honor is if the only desire and drive behind all of this is to get a card, even if the game must be played dirty.

There is a bit of that going on. This was the reason why some DXers were disgusted and tried to get something done about it. Apparently, the ARRL wouldn't do much about it so *they* decided to do something. What they did? QSL scam! Remember Abscam? Similar thing. They went ahead and printed copies of many rare QSL cards and made them available to those who wanted them. You would think that those who wanted to get on the Honor Roll would not go for it? Well, some did. It is best described in the letter by Dave Gardner K6LPL, well-known DXer and DXpeditioner. This letter was sent to *The DX Bulletin*, which broke the news on the whole affair. Here it is:

Approximately one year ago, a group of fourteen amateur radio operators both in the western United States and in Europe involving six countries got together and were discussing the sorry state into which DXing has fallen. It seemed to the group that the original purpose of DXing, the spreading of international goodwill and fellowship, etc., had degenerated into a new form of the hobby which we called "QSLing." At that time, our group, which includes ten members of the Honor Roll, attempted to figure out a way to make an impact on amateur radio, the ARRL, and DXing in general.

Our group has never been anti-League or anti-DXCC. What we are against is QSLing at any price, lack of concern for others, and the virtual disintegration of the generally good-natured camaraderie and willingness to help others that had characterized DXing in the past. The characteristics of DXing have become greed, avarice, and unconcern for others in search of the almighty QSL. Witness the plight of the poor, rare DX operator who gets on the air, and is totally smothered by stations in quest of the almighty QSL. This forces stations to resort to lists so that the poor guy can make a contact. This phenomenon has spread

throughout the world and is not just an American problem, as witnessed by the problems that the most polite of amateurs, the Japanese, had in the demonstration two years ago in China.

It was unbelievable to us how many "straight" amateurs accepted blank QSL cards and submitted them to the League. This is only the tip of the iceberg, as it is a well-known fact that working stations for friends while they are out of town or unable to work rare DX, and even phone-patching those stations through has become a commonplace, everyday habit.

No QSLs were sent out by our group for contacts during this sunspot cycle. Many members of our group have gone on numerous DXpeditions and it was decided that all of our respective QSL managers would be kept completely in the dark about this so as not to endanger their fine reputations. As far as we are concerned, this "operation" is over as we feel we have made our point. No further distribution of cards will be coming from our group. We estimate that between twenty and twenty-five thousand *[emphasis added] QSL cards have been sent and accepted by amateurs throughout the world in every continent except Antarctica.*

We must stop this insane QSL chasing and go back to DXing for the sake of DXing and not just for the sake of a QSL card.
David G. Gardner, M.D. K6LPL

As a result of this, a number of DXers were already disqualified. I think it would be only fair in order to preserve the credibility of the DXCC and the Honor Roll to ask those who are on it or fall in the time frame of the QSL scam to submit their cards for verification. It may be a lot of work, but perhaps there might be some volunteers that can help.

Another questionable way of obtaining QSLs is the operation list. Quite often, the two stations do not hear each other and the report and callsigns get passed by a "third party," the net control. This is definitely not the way to do it and you should stay away from it as much as you can. Don't forget: The whole world is listening and they hear you. What would they think about you? Stay clean! Back in the old country, they used to say that honor is worth more than anything else.

HOW TO QSL?

Generally, I would say QSL to those that you really need. There are some types that QSL anything that moves. For example, you work him in the contest three times on the same band, and you get three QSL cards. You probably already have about ten of them in your collection. This is just an unnecessary burden for the post office, your QSL bureau, your friend, and your pocket, too.

The best thing to do is to keep some kind of records. This is usually done when you are brand new and eager to get a QSL card for each contact you made. I used to have a very nice tracking system, with a book, divided by countries. I used different colors for different bands and modes and then an overall table showing which country was worked, confirmed, and on what band and mode. So, you always know where you stand. Then I gave up after over 40,000 contacts were made; it is just impossible to do that and have the time to operate. The contest logs are nuisance enough.

It is also advisable to keep a record of cards sent out directly and to which QSL manager, so you can try again if for some reason you don't get a reply. As they say: The QSL is the final courtesy of the QSO. It is polite to answer all the requests for your cards. There is no legal right to obtain a card; you can't sue anyone because he did not send you one. You can feel miserable about him, and perhaps "won't hear" him when you fire up from China, but that is about it.

I have experienced a number of threatening letters with exclamation marks just because a guy did not get his card within 24 hours. Well, sometimes there might be reasons for a delay: Cards are not printed, logs are not in the hands of the QSL manager, the boat is going there only once a year, etc.

The contesters are sometimes in a special situation. Usually, the typical multi-multi station can easily make 10,000 contacts on a weekend and this happens about 4 to 6 times a year. It is difficult to QSL everyone contacted. Gentlemen will at least answer all requests. It might take a little longer, but they usually do. This is where those younger and eager hams can perhaps offer to help a contester by volunteering his QSL services. It will give them a chance to get involved in a super-station, learn something, and be of help to many others.

Generally we can divide the QSL types into three groups: regular, rare, and special.

Regulars would be the ones that are around a lot and if you did not get this one to reply, there is always another one. Those we usually QSL via the bureau. Don't waste your money on postage. Put them in a bundle, nicely sorted in alphabetical order by countries and prefixes, and send them to your QSL bureau. Then wait (and wait), especially if it is Box 88, Moscow. Things are slow there. Find out what your local bureau situation is. The ARRL now is running the QSL bureau for outgoing cards. See *QST* for details. Incoming cards are going through the ARRL and local call area volunteers.

It is necessary to have a sufficient number of SASEs with them. Otherwise, cards will be destroyed after a certain period of time. Most of the other countries have their QSL bureaus run by their national amateur radio organizations and they handle all incoming and outgoing cards. Caution: Some hams are not members of the organizations and the bureau is not handling cards for them—cards usually get returned.

It is safe to say that for all the eastern European countries, the bureau is the safe and sure way of getting the cards. When there is a big bundle of cards to be sent out to, let's say, Japan, you will probably be better off to send directly to Japan rather than through your bureau. The cost difference will be small and they can go via slow boat rather than airmail.

Rare ones are those who are rare: There is maybe only one ham in the country, the activity is very sporadic, or the mail service occurs only once a year (like ZD7 or VE with all the postal strikes, hi). Then it is worth it to find out what the best QSL route is. Many times the rare ones have a QSL manager, and if it is a good one, it is easy to get the card. You send the card directly to him. Just remember, he is probably handling over 50,000 cards a year (W3HNK), so make the job easy for him. Make sure that you include an SASE, with the correct postage affixed.

Remember, Canada is not a part of the US and, therefore, it has its own stamps; don't put US stamps on the envelope. If you are desperate, maybe include unglued stamps. They can be used by the manager for his SASEs. But the best thing to do is always to use the stamps of the country that the manager is in, and the correct amount. If you don't have them or cannot obtain them (some philatelic stores have unused stamps of almost all countries in the world), then use IRC coupons. Those are the coupons that you can obtain at your local post office. So, it is a good idea to drop a note to him and ask how many and how much.

One IRC is usually worth the postage of one unit of postal weight in the country at regular, surface mail. Air mail is more and the *Callbook* lists some of the rates to various countries. Usually, three IRCs are sufficient for airmail from most of the countries.

Some countries (most of east Europeans) have 100% censorship at their post offices, so be careful what you are writing so you do not put a ham in jail. Remember, not all countries have the freedom that we in the West enjoy. Some of them prohibit foreign currency and it simply gets removed and put in the State fund. Box 88 apparently even removes the IRCs. Some countries are looking for callsigns on the envelopes and that tells them that there is meat in the envelope—they take it. Or, sometimes there is an unscrupulous postmaster who does that. So, generally, even if you are proud of your callsign, it is better not to put it on envelopes, especially those going to the East or to Africa. This is why the QSL managers are doing their thankless job and serving DXers.

Always make sure that all the information on the QSL card is correct and spend some time doing that. A manager might have lots of work to do with your sloppy card if you did not put your time, date, or band correctly on the card. Remember, he might have 340 QSOs for *one hour* in his log and he has,

perhaps, *5000 QSOs on one band* from that contest station. Double-check your info, and don't make him search through 10,000 QSOs for that *one* you made. Make sure that your date and time are always in GMT (or UTC, as they call it now). Your QSL card is like your picture, so try to look nice.

Special ones would be all those who are either extremely rare or very difficult to get cards from; it is advisable to find out the QSL info right away. This happens when an amateur is assigned to work there or is passing by the country and is active for a very short period of time. A number of DXpeditions fall here, too. You must QSL as soon as possible, before the logs get lost, the QSL manager gives up, etc. Excellent help is provided in the various bulletins and QSL manager lists. To mention two, there is the very sizable W6GO/K6HHD list (Box 700, Rio Linda CA 95673) and the *QSL Report* by QSL Management Association, c/o JH1HWN. Those have the latest, up-to-date information in them, usually taken from the DX bulletins and nicely sorted out and summarized. There is, of course, the *Callbook*, which lists all the hams in the world, and it is almost a must for those who are just starting their QSLing.

I hope that this will shed some light on the art of QSLing. It is always advisable to consult your local big gun if you are not sure. Good luck and may your returns be 100%.

DX NEWS

XZ Burma is getting better and better. Apparently, the station was improved by the installation of a beam and amplifier and operators are starting to work on their own, without the lists. QSL via JA8BMK for XZ5A and XZ9A.

HHØN Navassa operation by a number of operators from Haiti. Operators are trying to do their best and, apparently, Haiti is claiming the island. If Navassa is part of Haiti, then most likely it will lose its separate country status. QSL via WD4JNS.

YOØWUG and other calls with the YOØ prefix are being used to commemorate the world University Games, or Universiade as it is also known.

9Q5VT Zaire is quite active by Len and also shortly by W5VR. QSL via W5VR.

KH6IJ is recovering nicely from his stroke. Worked him recently on CW and he still has a problem with coordination, but it is great to hear that famous call on the air again. One of world's best operators ever. Speedy recovery, Katashi.

Africa. A number of expeditions are wandering around; watch out for the announcements. Most of them are very sporadic, waiting for the licenses.

A7XE operating around 21025, QSL via DF4NW.

AX Australia. Special prefix was used for Prince Charles' wedding commemoration. AX9NL was quite active. QSL cards to their respective VK callsigns.

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40-20-15-10 meter --- 2 trap ---54 ft. with 90 ft. RG58U - connector - Model 100BUA ... $78.95
20-15-10 meter --- 2 trap --- 26ft. with 90 ft. RG58U - connector - Model 1007BUA ... $77.95

SEND FULL PRICE FOR POSTPAID INSURED. DEL IN USA (Canada is $5.00 extra for postage - clerical - customs etc)or order using VISA - MASTER CHARGE - CARD - AMER EXPRESS. Give number and ex date. Ph 1-308-236-5333 9AM - 6PM wrctn days. We ship in 2-3 days. ALL PRICES WILL INCREASE. SAVE - ORDER NOW! All antennas guaranteed for 1 year 10 day money back trial if returned in new condition! Made in USA. FREE INFO AVAILABLE ONLY FROM WESTERN ELECTRONICS Dept. A7-10 ✓80 Kearney, Nebraska, 68847

ALL BAND TRAP ANTENNAS!

Orbit

ORBIT is the Official Journal for the Radio Amateur Satellite Corporation (AMSAT), P.O. Box 27, Washington, DC 20047. Please write for application.

For a **FREE SAMPLE COPY** please send $1 to cover First Class Postage and Handling to: Orbit, 221 Long Swamp Road, Wolcott, CT 06716.

HAM HELP

I need any info on a Packard Bell oscilloscope, model 5mc 2P— schematic, manual, etc. I will pay copying and postage or will copy and return original. Thanks.

Harl Goodsell W7LTH
70 S. 2nd East
Hyrum UT 84319

I need a March, 1975, issue of *73 Magazine*. I also need help in obtaining a Hewlett-Packard HP-46 with the optional LED display and a Fisher HC-10 Stereo reverberator.

Ham Help is my last resort in attempting to find these items.

Please send information you may have toward my obtaining these items.

George E. Weinbender
PO Box 747
Lake Havasu City AZ 86403

I would like to correspond with anyone who has converted the ARC-21 or ARC-65 surplus rigs. I have the ARC-65 tech manual and an extra control head.

Mark Meltzer
335 Prentiss St.
San Francisco CA 94110

✓See List of Advertisers on page 130

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CALIFORNIA QSO PARTY

Starts: 1800 GMT October 3
Ends: 2359 GMT October 4

This event is sponsored by the Northern California Contest Club, with strong efforts being made to have all 58 counties in California on for the contest duration.

Single-operator stations may operate only 24 hours of the contest period; off-times must be clearly marked in the log. Multi-operator stations may operate the full 30 hours. Stations may be worked only once per mode per band. All contacts must be simplex. All CW contacts must be made in the CW subband. California stations that change counties are considered to be new stations and may be contacted again for points credit.

EXCHANGE:

California stations send QSO number and county. Others send QSO number and state, province, or ARRL country.

FREQUENCIES:

Novice—3725, 7125, 21125, 28125.
CW—1805, 3560, 7060, 14060, 21060, 28060.
SSB—1815, 3895, 7230, 14280, 21355, 28560.
Try CW on the half hour and 16 meters at 0500.

SCORING:

Each completed phone contact is worth 2 QSO points. Each completed CW contact is worth 3 QSO points. For multiplier, California stations use the number of states, VO/VE 1-7, and VY1/VE8, for a possible of 58. Others use the number of California counties worked for a possible total of 58. The final score is the number of QSO points multiplied by the total number of multipliers.

AWARDS:

Certificates for highest-scoring station in each California county, each state/province, and each country. Trophies to the highest-scoring out-of-state single-op, highest-scoring California single-op, and highest-scoring DXpedition to a California county.

ENTRIES:

All logs and summary sheets must be sent by November 1st to: NCCC, c/o Dennis Egan N6QW, 811 Byerley Avenue, San Jose CA 95125. Please include an SASE with your entry.

NINE-LAND QSO PARTY

Starts: 1800 GMT October 10
Ends: 2359 GMT October 11

A maximum of 24 hours of the 30-hour period may be worked. The same station may be worked once per band and mode. If any stations change counties, they may be worked again.

EXCHANGE:

Nine-land stations send RS(T), county, and state. Others send RS(T) and state, province, or ARRL country.

FREQUENCIES:

Novice—3725, 7125, 21125, 28125.
SSB—1815, 3895, 7230, 14280, 21355, 28600, plus VHF.
CW—1805, 3560, 7060, 14060, 21060, 28060, plus VHF.

SCORING:

Each QSO is worth 2 points. Nine-land stations compute final score as: total QSO points times the total number of states, provinces, ARRL countries, and nine-land counties. Others multiply QSO points by total number of nine-land counties.

AWARDS:

Certificate to top score in each state, province, and ARRL country; 2nd and 3rd places if justified. Also, awards for top mobile, portable, multi-single, multi-multi, club, and Novice.

ENTRIES:

Submit summary sheet and log. Each new multiplier shall be clearly indicated. Send logs and a large SASE to III Wind Contesters, c/o John W. Sikora WB9IWN, 8747 Northcote, Munster IN 46321.

JAMBOREE ON-THE-AIR

Starts: 0001 GMT October 17
Ends: 2400 GMT October 18

It's Jamboree time again! Time for Scouts, former Scouts, and anyone interested to meet on-the-air for a weekend of good Scout talk. It gives amateurs and Scouts worldwide a chance to listen to or talk with other scouts and in some cases where

RESULTS

BRITISH AMATEUR RADIO TELEPRINTER GROUP
1981 SPRING CONTEST RESULTS
Single Operator

Callsign	Points	Total QSOs	Countries
W3EKT	598000	364	37
I5FZI	577720	296	46
EA8RU	537544	346	36
W3FV	466334	271	39
K7BV	445760	281	37
G3HJC	436028	247	34
WB3CCZ	380820	232	37
W4CQI	377936	249	35
GM3ZXL	377140	226	38
SM6ASD	373430	233	32

Multiple-Operator

LZ1KDP	489464	296	39
LZ2KRR	465052	277	37
HA5KBM	403300	254	35
I5NUT	328388	197	38
HG6V	273734	216	33
OK1KPU	133952	120	28
OK3RJB	110770	130	30
SP1PBW	51192	103	19
HA6KVD	34074	47	16
SK6DG	18942	31	12

Shortwave Listener

Name/Call	Points	QSOs	Countries Heard
OK1 11857 (Czech)	350200	224	43
H.Ballenberger (DL)	284068	195	37
OK3 27010 (Czech)	249916	224	34
Y2-5724/C (DM)	173128	137	33
K. Wustner (DL)	165240	139	28
Y2-6992/F (DM)	145542	145	26
A. Schnelfer (DL)	65800	68	27
Y2-8861/O (DM)	60080	51	28
Werner Ludwig (DL)	14460	19	5

RESULTS

160-METER
PHONE CONTEST
CLAIMED SCORES
Top Six, 1981

Single Operator:

Callsign	*State*	*Score*
W8LRL	WV	383,625
K9RF	CO	333,660
WB9CMM	CO	256,880
W9RE	IN	224,960
W3YOZ	MD	217,500

Multi-Operators:

W4CN	KY	198,645
WA9EYY	IL	193,475
WD9BNC	KS	176,985
WD9BRD	NE	169,750
W9ZX	IL	170,725
KA9F	IL	97,500

Final results to be published in November or December *73*.

equipment is available for slow-scan television, to see them, also. By the way, this also includes Girl Scouts, Guides, and all Scout leaders.

Hams invite Scout groups to their shacks for the occasion, or Scouts seek out hams. Amateur radio clubs have lists of their members, and a list of such clubs is available from the ARRL, Attn: Sally O'Dell, Director Youth Activities, 225 Main Street, Newington CT 06111. Send an SASE with your request. Hams may contact local Scout offices for names of Scout leaders in their neighborhoods. Look for stations operating at camporees and other Scout events, K2BSA, the national headquarters amateur radio club station, and HB9S, the world Scout Bureau station.

Most operations will occur during the period of 0001 GMT Saturday to 2400 GMT Sunday, but since this is not a contest, operations may start Friday and go into Monday. There is no required contact format, no specific exchange, just Scouting fun. All operations must, however, adhere to FCC rules and regulations.

FREQUENCIES:

Scout frequencies published by the World Bureau are as follows:

Phone—3740, 7090, 7230, 14290, 21360, 28990.

CW—3590, 3750, 7030, 7130, 14070, 21140, 28190.

SSTV and RTTY on usual frequencies.

Since the 3740 and 7090 phone frequencies are outside the USA phone bands, overseas stations using those frequencies may listen inside adjacent USA phone bands or respond to CW calls.

Postcard-size certificates designed by an Australian Scouter and issued by the World Bureau are available from JOTA Coordinator Harry Harchar W2GND, 216 Maxwell Avenue, Hightstown NJ 08520, for anyone participating. Send an SASE with sufficient postage for their return, one ounce per eight cards. They may be requested before the JOTA weekend for distribution then, or for award at Scout Courts of Honor or other meetings.

Logs or lists of participants are not required, but reports of activity and photos are welcome for inclusion in the BSA report to the World Bureau and possible use in Scout publications. Send them to the JOTA Coordinator mentioned above.

CALENDAR

Oct 3-4	**California QSO Party**
Oct 10-11	**Nine-land QSO Party**
Oct 17-18	**Minnesota QSO Party**
Oct 17-18	**Scout Jamboree On-the-Air**
Oct 17-18	**Pennsylvania QSO Party**
Oct 17-18	**QRP ARC International CW QSO Party**
Oct 24-25	**CQ World Wide DX Contest—Phone**
Nov 7-8	**Antigua and Barbuda Independence QSL Party**
Nov 7-8	**IPA Contest**
Nov 8	**DARC Corona—1-meter RTTY**
Nov 8	**OK DX Contest**
Nov 14-15	**European DX Contest—RTTY**
Nov 28-29	**CQ World Wide DX Contest—CW**
Dec 26-31	**G-QRP-Club Winter Sports**
Jan 9	**73's 40-Meter Phone Contest**
Jan 10	**73's 80-Meter Phone Contest**
Jan 16-17	**73's International 16-Meter Phone Contest**
Jan 16-17	**International SSTV Contest**

QSL OF THE MONTH

This month's winner was submitted by Andy Schaefer N7AST of Hackensack MN and Mesa AZ.

If you would like to enter the contest, put your QSL *in an envelope* and mail it along with your choice of a book from 73's Radio Bookshop to *73 Magazine*, Pine Street, Peterborough NH 03458. Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does occasionally damage cards) and do not specify book choice will not be considered. Sorry.

RESULTS

10TH ANNUAL COUNTY HUNTERS SSB CONTEST

Plaques to be awarded to the highest-scoring fixed US or Conadian station, DX station and mobile station, and second highest-scoring mobile station. Certificates to the top 10 fixed and mobile stations in the US and Canada and to the highest-scoring station in each DX country.

Fixed Station		Mobile Station	
N7TT	5,680,752	N4UF	1,049,489
AG9S	3,204,720	WA5DTK	1,034,150
WB3CFD	1,481,063	WB0CQO	131,500
VE1RQ	1,292,988	W0QWS	127,655
W1CHA	638,768		(check log)
W9CA/4	414,630	W1EXZ	67,130
W3ARK	275,850	AC8Y	49,410
K9GDF	165,750	K3LHD	23,655
WB6GMM	137,000	KS0AQS	14,300
WB3IET	46,464	W2PDM	6,720

DX Station

WB5KEA/KP4	2,801,568	SM0CHA	111,650
I2PHN	514,400	CT1TZ	81,900
SM5CAK	241,380	CT1UA	78,240
CT7SL	173,679	G4HBI	53,060
GW3CDH	140,400	SM4DHF	36,938

QRP ARCI CW QSO PARTY

Starts: 1200 GMT October 17
Ends: 2400 GMT October 18

The contest is open to all amateurs and all are eligible for the awards. Stations may be worked once per band for QSO and multiplier credits. Participants must be off the air at least 12 hours in not less than 6-hour periods.

EXCHANGE:

Members—RST, state-province-country, and QRP number. Nonmembers—RST, state-province-country, and power output. Novices and Technicians add /N or /T after the QRP number or power.

SCORING:

Each member QSO counts 5 points regardless of location. Nonmembers' QSOs are 2 points with US and Canadian stations; others are 4 points each. Nonmember Novice and Technician contacts count 3 points. Multipliers are as follows: 4-5 Watts—×2; 3-4 Watts—×4; 2-3 Watts—×6; 1-2 Watts—×8; less than 1 Watt—×10. Stations are eligible for the following bonus multipliers: if 100% natural power (solar, wind, etc.) with no storage, ×2; if 100% battery power, ×1.5. Final score is total QSO points times total number of states-province-countries per band times the power multiplier and times the bonus multiplier (if any).

FREQUENCIES:

1810, 3560, 7040, 14060, 21060, 28060, 50360.
Novice/Tech—3710, 7110, 21110, 28110.
All frequencies plus/minus to clear QRM.
Note: VHF/UHF contacts must be direct—no repeater contacts are allowed.

AWARDS:

Certificates to the highest scoring station in each state, province, or country with 2 or more entries. One certificate to highest-scoring Novice/Technician overall.

LOGS AND ENTRIES:

Send full log data, including full name, address, and bands used, plus work sheet showing details and time(s) off the air. No log copies will be returned. Please indicate if you are a Novice or Technician. All entries desiring results and scores please enclose a business-size envelope with return postage. It is a condition of entry that the decision of the QRP ARCI Contest Chairman is final in case of dispute. Logs must be received by November 20th to qualify. Send all logs and data to: QRP ARCI Contest Chairman William W. Dickerson WA2JOC, 352 Crampton Drive, Monroe MI 48161.

PENNSYVANIA QSO PARTY

1700 GMT October 17 to 0400 GMT October 18
1300 GMT October 18 to 2200 GMT October 18

Sponsored by the Nittany Amateur Radio Club, this is the 24th annual event. Stations may be worked once on each band on each mode. Mobiles may be reworked as they change counties. Repeater contacts do not count.

EXCHANGE:

RS(T), 3-digit sequential serial number, and ARRL section or Pennsylvania county.

FREQUENCIES:

SSB—3980, 7280, 14280, 21380, 28580.
CW—40 kHz up from bottom of CW bands.

SCORING:

Count 1 point for SSB QSOs, 1.5 points for CW QSOs, and 2 points for 80-meter CW QSOs. Pennsylvania stations multiply QSO points by the total number of ARRL sections, plus the total number of Pennsylvania counties, plus a maximum of one DX country. Others multiply QSO points by the total number of Pennsylvania counties worked. Mobiles in Pennsylvania calculate their total for each county and then add these county totals together for the final score.

AWARDS:

Handsome plaques will be awarded to the top Pennsylvania and out-of-state entrants. Certificates for section winners and the 10 top Pennsylvania entrants with a minimum of 10 QSOs. Special club award: An engraved gavel will be awarded to the Pennsylvania club whose members score the highest aggregate scores in the contest.

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Eight character moving display.
Built-in code practice oscillator.
Excellent for learning Morse Code.
Complete — no CRT or expensive extras needed.
Decodes audio CW signals from your receiver's speaker and displays letters, numbers, punctuation and special Morse characters as the code is received.

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GDO-33 24.125GHz 10mw transmitter
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Horn antennas also available.
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7800P7G08 1.1-1.7GHz 7800P7G04 1.3 - 2.6GHz
7800P7G01 2.6 - 4.2GHz
5 for $5.00 no mixing. Data provided

SOLDER-IN DISK CAPACITORS for VHF-UHF bypassing
RMC JF series 100, 220, 470, 680pf 10 for $2.50

OPTOELECTRONICS from Siemens:
LD271 High efficiency infrared LED $1.00
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Be sure to indicate club affiliation on your logs!

ENTRIES:

Dupe sheets are required for entries with 100 QSOs or more. Mail logs, dupe sheets, comments, and an SASE (for results) by November 15th to: Douglas R. Maddox W3HDH, 1187 S. Garner Street, State College PA 16801.

MINNESOTA QSO PARTY

Starts: 1700 GMT October 17
Ends: 2259 GMT October 18

This year's contest is sponsored by a newly-formed club in the Brainerd, Minnesota, area, the Paul Bunyan Wireless Association. There are no mode or time restrictions, but only one transmitter is allowed in operation at one time. No crossband contacts are allowed. Novices compete with Novices, Technicians with other Technicians. Phone and CW are considered the same contest—please score as such. Net QSOs are not valid!

EXCHANGE:

RS(T) and ARRL section/country or Minnesota county.

FREQUENCIES:

Phone—3933, 7233, 14300, 21433, 28633.
CW—3633, 3733, 7033, 7133, 14033, 21033, 21133, 28033, 28133.

SCORING:

Minnesota stations multiply total number of contacts times the number of sections and DX countries. Others multiply number of QSOs by the number of Minnesota counties worked. Score one point for phone QSOs and two points for CW QSOs. Any contact with AD0S counts 10 points per QSO on each band, 80 through 10 meters. If you contact AD0S on 3 or more bands, add 25 points bonus!

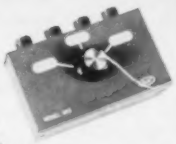
ENTRIES:

Logs must include date/time in GMT, bands, modes, and exchanges. Logs must be postmarked no later than November 20th and addressed to: Paul Bunyan Wireless Association, c/o Steven Scott WD0EPE, 801 6th Street North, Staples MN 56479. Include a business-size SASE for returns. Usual disqualification and awards procedures.

Continued

See List of Advertisers on page 130

new COAX SWITCHES
from Barker & Williamson



Model 593

- ***Single Pole*** 3 Position with grounding of all unused positions
- ***Crosstalk*** (measured at 30 MHz) is -45db between adjacent outlets and 60 db between alternate outlets

Model 594

- ***2 Pole 2 Position***
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Specifications for both switches

- ***Power*** 1 KW-2 KW PEP
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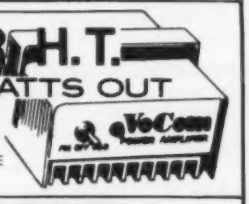

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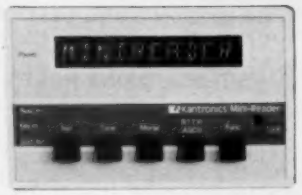
Copy RTTY, ASCII and Morse from the palm of your hand.



Have you waited to get into code reading until you found out what this latest fad was about? You can stop waiting, because it's no longer a fad.

Amateurs everywhere are tossing the gigantic clanking monsters of yesteryear that once performed the job of reading radioteletype. They are trading them in for state-of-the-art code-reading devices that are incredibly small, noiseless if desired and infinitely more versatile than their antique predecessors.

Kantronics, the leader in code-reading development, has just introduced the latest and most-advanced breakthrough in the copying of Morse code, radioteletype and ASCII computer language.

The **Kantronics Mini-Reader** reads all three types of code, displays code speed, keeps a 24-hour clock, acts as a radioteletype demodulator and reads all of its decoded information out on a traveling display of 10 easy-to-read characters. It is so compact that it fits in a hand-held, calculator-size enclosure.

At $314.95, the **Mini-Reader** outperforms anything within another $400 of its price range.

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Kantronics
(913) 842-7745
1202 E. 23rd Street
Lawrence, Kansas 66044

1st ANNUAL 40- AND 80-METER PHONE CONTEST

SPONSORS:
73 Magazine, Peterborough, New Hampshire 03458

CONTEST PERIODS:
40-Meter Event—0000Z to 2400Z January 9, 1982
80-Meter Event—0000Z to 2400Z January 10, 1982

MISCELLANEOUS RULES:
Work as many stations as possible on 40- and/or 80-meter phone during the specified times of allowable operation. The same station may be worked once on each band. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours on each band. All multi-operator stations may operate the entire 24-hour period on each band. Off periods must be noted in your logs and on your summary sheet. Off periods are no less than 30 minutes each.

OPERATOR CLASSES:
(A) Single-operator, single transmitter, phone only
(B) Multi-operator, single transmitter, phone only

ENTRY CATEGORIES:
(1) 40-meter band only
(2) 80-meter band only
(3) 40- and 80-meter bands

EXCHANGE:
Stations within the continental US and Canada transmit an RS report and state, province or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:
A station may be worked once on each band. US/VE stations earn 1 QSO point per contact with the 48 states and Canada, 2 points for all others. DX stations (including Alaska and Hawaii) earn 1 QSO point per contact within your own country, 2 points for all others. Contacts made between 1000 and 1400 local time score twice the normal points per contact. Indicate points per contact on your log sheet.

MULTIPLIERS:
1 multiplier point is earned for each US state (48 max.), each Canadian province or territory (12 max.), or each DX country worked on each band.

FINAL SCORE:
Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:
Each contest entry must include a log for each band in your entry category, a dupe sheet for each band, a contest summary, and a multiplier checklist for each band. We recommend that contestants send for a copy of the contest forms. Enclose an SASE to the contest address listed below.

ENTRY DEADLINE:
All entries must be postmarked no later than February 11, 1982.

DISQUALIFICATIONS:
Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:
Contest awards will be issued in each entry category in each of the continental US states, Canadian provinces and territories, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:
Send an SASE to: Whidbey Island DX Club
2665 North Busby Road
Oak Harbor, Washington 98277

SQUELCH TALES

SAN DIEGO REPEATER ASSOCIATION

VOLUME XI JUNE, 1981 NUMBER 6

SANDRA HAMS SCORE IN EMERGENCY

Last week, SANDRA members via a SANDRA repeater performed an act exemplifying the public service spirit and resourcefulness of Amateur Radio.

At about 1:25 AM on June 2, WB6DIS, Lenny Provencher, preparing to make his rounds delivering milk to commercial establishments, observed the start of a fire on the second story of a small hotel at 15th and J in downtown San Diego. First on the scene, he keyed up the SANDRA Mt. Otay repeater, 146.04/64, with his mobile rig. He immediately raised WA6REC, Joe Wilkerson, Jr., who promptly notified the fire department.

Lenny meanwhile entered the building, awakening 15 sleeping residents and assisted elderly people to safety.

The building rapidly became engulfed in flames, but the fire department arrived promptly, saving those trapped on a second story fire escape, and salvaging three fourths of the structure. The only serious injury was to a gentleman who suffered a fractured pelvis and other injuries when he jumped from the second story.

The San Diego Union headline on this story was "Human Pulled From Flames".

Amateur radio may have saved many lives here.

NEXT MEETING

Our next membership meeting will be held June 19, 7:30 PM, at the North Park Recreation Center, 4044 Idaho St. All things being equal, we will be honored by the presence of William H. Grigsby, Engineer in Charge of our local FCC office, and June Alonso, our local FCC contact representative. These folks have accepted our invitation, conditional on return from traveling by Grigsby that week.

Your questions will be answered. June suggests that if you want to ask about issues that may have had recent rulings, let her know at 293-5470 in advance so that research can be made if necessary.

VOX POP

VOX POP. Remember your high school Latin? Vox populi, "the voice or opinion of the people", showed up on SANDRA net the other night. See our lead article for the results.

NEWSLETTER CONTEST WINNER

Does your club want a newsletter but can't find a way to pay for it? You should consider the approach that is used in *Squelch Tales*, the monthly newsletter of the San Diego Repeater Association. By selling advertising, they are able to meet or exceed the cost of publishing their newsletter. This seems to work well for other clubs, too; about one in three of the club newsletters sent to *73* contains advertising.

The edition of *Squelch Tales* that we selected was 24 pages long—nine of those pages were ads. The club, which has almost 900 members, charges $30 for a full page, $15.00 for a ½ page and $7.50 for a ¼ page or business-card-size ad. Advertisers are encouraged to submit their own layouts and artwork, but the newsletter will also provide assistance free of charge.

Advertising can be a good shot in the arm for a club budget, provided the job is done right. First and foremost, the ads won't sell themselves. The newsletter staff will need to contact prospective advertisers and then *convince* them of the merits of spending money to reach the club's members. Likely candidates include the local ham gear dealer, electronics parts stores, and surplus houses. After all, this is where hams spend their money.

The cost of advertising should reflect the size of your club, the quality of the newsletter, and most important of all, the additional expense that is involved when you run the ad. It

3rd ANNUAL INTERNATIONAL 160-METER PHONE CONTEST

SPONSORS:
73 Magazine, Peterborough, New Hampshire 03458

CONTEST PERIOD:
0000Z January 16, 1982, to 2400Z January 17, 1982

OBJECT:
To work as many stations as possible on 160-meter phone in a maximum of 36 hours of allowable contest time. Multi-operator stations may operate the full 48-hour contest period. Stations may be worked only once!

ENTRY CATEGORIES:
(1) Single operator, single transmitter, phone only (2) Multi-operator, single transmitter, phone only

EXCHANGE:
Stations within the continental US and Canada transmit RS report and state, provinces or territory (i.e., 59 Iowa, 55 Ontario, etc.). All others transmit RS report and DX country.

POINTS:
Five (5) points will be earned for each valid contact with stations in the continental US and Canada. DX contacts outside the continental US and Canada score ten (10) points each. This year for the first time, an additional 5 points *bonus* may be earned for each contact made during the hours of *1000-1400 local time* on either day of the contest.

MULTIPLIERS:
1 multiplier point will be earned for each of the 48 continental states, twelve (12) Canadian provinces/territories, and DX countries outside the continental US and Canada worked during the contest.

FINAL SCORE:
Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:
Each contest entry must include logsheets, dupe sheets for 100 contacts or more, a contest summary sheet and a multiplier check sheet. Please note those contacts made between 1000-1400 local time so you'll be sure to get appropriate contest credit.

ENTRY DEADLINE:
All entries must be postmarked *no later than February 18, 1982.*

DX WINDOW:
Stations are expected to observe the DX window from 1.825-1.830 MHz as mutually agreed by top-band operators. Stations in the US and Canada are asked not to transmit in this 5-kHz segment of the band.

DISQUALIFICATION:
If contestant omits any required entry form, operates in excess of the legal power authorized for his/her given area, manipulates operating times to achieve a score advantage, or fails to omit duplicate contacts which may reduce the overall score more than 2%, disqualification may result.

AWARDS:
Contest awards will be issued in each entry category in each of the continental US states, Canadian provinces/territories, and each DX country. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:
To obtain information, entry forms, or to submit a contest entry, forward a *self-addressed stamped envelope* to:

160-Meter Phone Contest
Dan Murphy WA2GZB
Post Office Box 195
Andover NJ 07821 USA

doesn't make much sense to sell an ad for less money than it costs to print and mail.

A good rule of thumb is that the revenue from one page of advertising should pay for two or three pages of the newsletter. For example, a 10-page newsletter that costs $80 to print and mail might have four pages of ads costing $20 each. To keep the readers happy, you can't replace editorial material with ads. Nor can you expect advertisers to pay a small fortune to reach a handful of people.

Advertising alone does not make a good newsletter. *Squelch Tales*, like our earlier winners, has a nice mix of club news, technical tips, and humor. One nice touch is a classified section in which members can list gear. The success of this newsletter is largely the result of a hardworking staff. Editor W6GIC has been associated with the publication for ten years. Her enthusiasm is matched by that of W6UZL who, as a retiree, has plenty of time to gather the news. Rounding out the team is WA6IPW, who uses his background as a printer to ensure that each new edition looks professional yet is reasonable in cost.

If your club is suffering from newsletter blues, perhaps an injection of advertising will help. This revenue, combined with some hard work, will yield a publication that members can look forward to receiving each month. For those of you working on newsletters: Keep up the good work and make sure that your club's publication is being sent to *73*.—N8RK.

HAM HELP

I need manuals or schematic and alignment data on the Knight Star Roamer and the Hallicrafters S-38 "D" receivers. Xerox copies will be OK.

O. L. Sabetto W8ZXG
1717 Burgess Road
Cleveland OH 44112

I am looking for software and equipment compatible with a NorthStar Horizon computer to work RTTY. All help appreciated.

Marc Rubin
16692 Bolero Lane
Huntington Beach CA 92649

I am in need of manuals or any information on the following equipment: Data Engineering, Inc., Space-Matic Electronic keyer; Kyokuto FM 144-10SXRII 2-meter FM synthesized rig; and Ebina Electronics Corp. M7505 10-kHz-30-MHz frequency counter. I will pay for copy or copy and return.

Bob Carson N8CUX
Box 364
Smithfield OH 43948

I would like to get in touch with amateurs interested in Esperanto, the auxiliary language, for the purpose of forming an international ham net.

Ernest Black K2REV
1265 Reservoir Road
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61AB6

FCC

INQUIRY BEGUN ON SPREAD-SPECTRUM MODULATION IN AMATEUR RADIO SERVICE (DOCKET NO. 81-414)

The Commission has begun an inquiry and rulemaking into whether to allow certain amateur radio users to use spread-spectrum modulation techniques.

In another action, the Commission is exploring the broader area of wideband technologies, including spread spectrum, and said the inquiry/rulemaking involving amateurs would provide the FCC with useful data about the performance of such techniques in the presence of other communications systems.

Wideband modulation techniques differ from conventional modulation schemes—such as amplitude modulation (AM) and frequency modulation (FM)—in that the bandwidth of the transmitted signal is much wider than the bandwidth of the information being sent. Because of the increased bandwidth, such techniques are implicitly prohibited by current rules.

Spread-spectrum techniques were originally developed for military applications concerning covert communications and/or resistance to jamming. The radio frequency signal transmitted in a spread-spectrum system occupies a very large bandwidth, perhaps many megahertz, as compared to the information signal's bandwidth. This wide bandwidth provides for a military signal that is very hard to detect or jam.

The Commission concluded that spread spectrum might offer unique advantages to civilian communications users also. The coding techniques used in spread-spectrum systems, for example, allow message privacy, selective addressing, and code division multiple access (many users simultaneously). These last two advantages provide the user the ability to selectively access only one or a fraction of the total number of receivers sharing the same spectrum. Spreading the signal at the transmitter and collapsing it at the receiver results in a low signal power density and helps the system reject interference. These features suggest the feasibility of overlaying spread spectrum on occupied spectrum, leading to increased spectral efficiency.

In March, the Commission's Private Radio Bureau authorized the Amateur Radio Research and Development Corporation (AMRAD) to conduct limited tests using spread-spectrum modulation. When this special temporary authority expires, AMRAD must submit its findings to the Commission, which will consider them in this proceeding.

Experimenting will be limited to amateur Extra and Advanced class licensees, whose members have been tested in advanced phases of radio electronics. Because spread-spectrum systems are inherently more complex than narrowband systems, the Commission said these licensees were best qualified to build and operate the necessary equipment so as not to interfere with other radio users. (Material covering spread-spectrum techniques will be added to future amateur Extra and Advanced class tests.)

Due to legal and technical considerations, the Commission proposes authorizing spread-spectrum modulation only in the 50-54-MHz, 144-148-MHz, and 220-225-MHz bands. However, it welcomes requests for special temporary authority to perform limited experiments in the amateur bands above 225 MHz.

The Commission will not limit system design, but only proposes that a system's authorized bandwidth be equal to or less than the width of the amateur band the system is operating in and be contained within that band. Although no interference problems are anticipated, local engineers-in-charge will be allowed to require stations transmitting spread-spectrum signals to cease operation, if necessary, to stop interference. Provisions to facilitate monitoring by the Field Operations Bureau and by other amateurs are proposed. Commenters may address the issue of interference potential in overlaying spread spectrum on the three aforementioned bands.

The inquiry notice lists questions that might guide those wishing to comment in this proceeding. Interested persons should obtain a copy of the notice.

Action by the Commission by Notice of Inquiry and Proposed Rulemaking (FCC 81-290). Commissioners Fowler (Chairman), Lee, and Quello, with Commissioner Washburn concurring and issuing a statement. For more information, contact Mike Kennedy at (202)-632-7073.

HAM HELP

Active or retired police amateur radio operators who are members or potential members of the International Police Association interested in forming an IPA Ham Radio Net please contact the Secretary-Treasurer of IPA, U.S. Section, Region 10, at 89 Oakridge Avenue, Nutley NJ 07110.

Rudolph A. Deutsch WA2MAU
89 Oakridge Ave.
Nutley NJ 07110

I am in need of a service manual and/or operations manual with schematic for the Hammarlund HQ-170. I also need service manuals for the Kenwood 599D twins (R-599D, T-599D). I'll pay postage and copying costs.

Frank Flohr
1016 18th Terrace
Key West FL 33040
(305)-296-2555

I am in need of the addresses for the following companies: Ferroxcube, Fair- Rite Products, and Stackpole. I would appreciate hearing from someone who can tell me where these companies are.

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HOORAY FOR HOLLYWOOD DEPARTMENT

About a year and a half ago, my friend, Jim Davis KA6IUH, was the program director for Los Angeles radio station KMPC. Thanks to Jim, I had a chance to meet and become friends with a number of darn nice people involved in one way or another with the KMPC operation. Among them is a man named Gary Owens. For many years, Gary was the afternoon mainstay of KMPC, though I suspect he is best known to the rest of the nation as the "announcer," with his hand always to his ear, on the old Rowan and Martin "Laugh In" series. Anyhow, one afternoon while I was visiting Jim in his office, I asked if he minded my asking Gary if he would record some public service announcements about amateur radio. Jim did me one better. He suggested we both ask Gary; we did, and Gary graciously agreed to do them.

That evening, I called Lenore Jensen W6NAZ. Lenore is the ARRL's Los Angeles area public information assistant. She's also directly responsible for 99.9% of all the amateur-radio-related announcements you hear on radio and see on TV. We worked out the details of what the announcements should say, and a week later Gary, Jim, and I recorded the copy onto tape. A few days later, my organization, the Westlink Radio Network, formally donated these recordings to the American Radio Relay League for use in their ongoing campaign to foster public awareness of amateur radio. Since then, they have been heard on radio stations nationwide.

In early July, a plaque thanking Gary for his efforts on behalf of all amateur radio operators was awarded to him by the ARRL through Lloyd Sigmon W6LQ. Having Lloyd be the presenter could not have been more appropriate since he was the man in charge of KMPC when Gary came to the station 19 years ago. Also present at the awards ceremony were Lenore (W6NAZ) and Bob (W6VGQ) Jensen. After thanking Lloyd and the League for the recognition, Gary promised to hook up a code-practice oscillator to the key, and practice a bit of CW with it. No, Gary isn't a ham, at least, not yet. But if he ever decided to take the plunge, he would be a welcome addition to our service.

As the individual who instigated this whole affair, I also would like to express my sincere gratitude to Gary. People in Gary's position are constantly bombarded with requests for similar freebies. I know a number of people who flatly reject any such request for any reason, and I cannot blame them for doing so. Remember, in the case of PSAs such as ours, virtually everything is donated including the talent. The latter is usually the most expensive part of producing a commercial of any sort. There's a Hollywood saying which goes, "Big names cost big bucks," and this is rightly so since for an entertainer or air personality, his or her voice and appearance are their livelihood.

What's nice is that a person of Gary's caliber and standing has as high a regard for our hobby service as to donate his talent in the hope that we can grow and prosper. For this, I can only say to him a simple but meaningful, thank you! I also want to thank Jim Davis KA6IUH along with Lenore Jensen W6NAZ. Putting these PSAs together was a team effort and everyone involved deserves a hand.

Famed broadcaster Gary Owens (left) receives a Brass Key plaque from Lloyd Sigmon WGLQ, on behalf of the ARRL. (Photo by Bob Jensen W6VGQ.)

A SPECIAL REPORT

The following is excerpted and being reprinted from the Spring, 1981, Southern California Repeater Remote Base Association Newsletter. I am bringing you this information for several reasons. First, like all other bands, the 420- through 450-MHz spectrum is facing its own form of crisis in many geographic areas, and herein you will find the details of how one group of dedicated radio amateurs plans to deal with the problems that lie ahead. Second, outside of those who use the band in Southern California, little is known by the outside world. Through this input, it is my hope (and I suspect that of SCRRBA as well) that all amateurs will have a better understanding of the need for ongoing voluntary spectrum management to prevent chaotic conditions from developing within our amateur relay spectrum. The report was prepared by Gordon Schlessinger WA6LBV of SCRRBA's Technical Committee. Due to its length and scope, it will be presented in several parts. First, some background for those of you unfamiliar with the group.

Like all other voluntary spectrum management organizations in California (and perhaps nation wide) the SCRRBA was a child of the original California Amateur Relay Council. From it came such well known regional organizations as the Northern Amateur Relay Council and the Southern California Repeater Association (which in 1978 again split into two "special interest" groups now known as TASMA and 220 - SMA). Over the years, this column has followed the political motivation leading to these changes toward regionalization and specialization, so I will not repeat them here. Those interested can find more detail by reading the back issues of *73* from mid-1972 through the present. I also tried to detail some of the history of California frequency coordination in my *Practical Handbook of Amateur Radio FM and Repeaters*, also available from *73*. (Yet another excellent reference is "The Remote Base: An Alternative To Repeaters," authored by Gordon Schlessinger WA6LBV and Bill Kelsey WA6FVC. This article appeared in the April, 1977, issue of *Ham Radio Magazine*. While technical in nature, it did spend time explaining some of the colorful history of UHF-relay communication in this region)

SCRRBA REPORT, PART I

For the Southern California UHF relay community, the future is now. In many respects, the future arrived yesterday. We are big; we are complex, and we have big complex problems to be faced. *Right now.* Whether or not we face them, whether or not we solve them, will entirely determine if we will continue to operate our relay systems in the future as we have in the past. Let there be absolutely no misunderstanding about this: A crisis in frequency coordination is already upon us.

In Southern California, we have developed a phenominal number of UHF relay systems, leading to the virtually complete utilization of the 440-450-MHz region of our 70cm band. This fact alone creates unprecedented difficulties for the Technical Committee both in coordinating channel pairs for new systems and in managing the present array of coordinated relay stations.

UHF Frequency Coodination In Crisis

"We begin with data. In Southern California, the 440-450 portion of the band is entirely used for 'relay station' input and output channels. The 420-431-MHz portion of the band, which previously supported some relay 'main input and output' pairs, has now been devoted entirely to link channels and a co-shared 6-MHz ATV simplex channel. The 431-440-MHz portion is utilized for 'weak signal' DX communications, satelite work, an ATV repeater input channel (output on 1250 MHz), and a few one-way link channels.

"Within the 440-450-MHz portion of the band, three channel pairs are reserved for simplex operation and associated special-purpose activities. This results in a theoretical 197 pairs for mobile relay channels available for coordination.

"At the present time, the Technical Committee frequency coordination data base shows a total of 320 systems coordinated to these 197 pairs, with several additional coordinations performed but not yet included in the latest computer printout. We therefore have, at present, an average of 1.6 coordinated systems per channel pair. Additionally, there is a backlog of applications awaiting coordination, for which supplemental data has been requested and has not yet been received. Finally, we are receiving a relatively constant number of completed applications for new UHF frequency coordinations each month. In the near future, we will exceed an average of 2.0 systems per channel.

"Compounding the channel-loading figures are some secondary considerations. The band was initially coordinated from the 'top down,' with the earliest coordinated systems utilizing output channels in the 448-450-MHz portion of the band. (In this discussion, only the output channel frequencies will be mentioned; the input channels, 5 MHz lower in frequency, are implicitedly included). Many of these early systems tend to be widely utilized, often by individuals who hold cross-membership in other groups as well. Consequently, the top end of the 440-450-MHZ band is already entirely filled. Additionally, one of the ostensible benefits of our Southern California location is also a constraint on the frequency-coordination process. High performance, wide-coverage systems coordinated to our highest mountains, dominate a channel over much of the populated Southern California land area. A channel pair which is in use on Santiago Peak or other mountains cannot easily be co-shared with another system anywhere else in the Southern California coastal region. Thus, to the degree that more and more systems are established on these mountains, the number of channel pairs available to be coordinated elsewhere in Southern California is reduced.

"Under these constraints, the Technical Committee must coordinate new systems onto channels which already contain at least one other operational system somewhere in Southern California. On this basis alone, there are potentially very large problems in UHF frequency coordination looming ahead. But there are additional problems that must be addressed."

Next month, we will cover these and begin to look at possible solutions as outlined by SCRRBA in its Special Report.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Ah, autumn! The leaves out here in the country are changing to the bright collage of red and gold, and I find myself outside, spraying WD-40 on the kids' swing set to protect the pivot from winter's rust. While I am outside, I often hear the familiar rumble of the postman's truck. Let's see what kind of goodies we can turn up in this month's mailbag.

A good starting point is this letter from Frederick C. Wood WB3JKC, here in the Baltimore area, who writes about his attempt to get on RTTY. Fred states that he is "...twelve years of age and a General class license holder." He recently acquired an old Model 19 Teletype® machine, along with an HF transmitter and receiver. A home-brew demodulator provides good receiving copy, but transmitting is his problem.

Fred installed the circuit shown in Fig. 1 in his transmitter, but has the following questions:

1) Where do I connect to from the FSK unit to the Model 19 machine keyboard? I do not have a manual for the Model 19 machine.
2) To obtain the 170-Hz shift, which I will be using for RTTY, simply, what are the adjustment procedures for the trimmer capacitor and the 100k shift pot?
3) Why is the keyboard grounded as indicated?

Fred concludes that he has been unable to find the answers to these questions despite several months of reading, and signs himself a "frustrated 12-year-old." I know that others have found themselves in the same situation as Fred; let's look at the answers to his questions.

To begin with, the Model 19, which is really a Teletype Model 15 with tape equipment, provides the connection for the keyboard on the machine's left side, your right as you look at it, on the "30" terminal block. This screw-terminal block has six terminals on it, numbered 31 through 36, and the keyboard is brought out to 32 and 34.

Now, before you just go and hook the keyer to these terminals, there is one more item you must attend to. On an unmodified Model 15 keyboard, there is a filter, officially dubbed a "9222 Filter," which serves to suppress sparking at the keyboard contacts. Composed of a coil and a few capacitors, this is the last thing you want to put across a shift-pot circuit! The filter is normally wired across the contacts and located above the keyboard contact assembly; remove it.

We move on to your second question, regarding adjustment of the circuit. The variable capacitor is set to provide the correct degree of shift, whereas the potentiometer is used to precisely set the shift. The way I set them up is first to turn the pot to maximum, that is, the higher position above ground. This will provide the maximum shift. Now adjust the capacitor to produce an 850- or 900-Hz shift. From here on, leave the capacitor alone! The pot may be used to back down the shift to 170 Hz, or whatever, without worrying about exceeding the 900-Hz maximum shift. I mounted the pot in a little box on top of the transmitter, with a jack in the back to receive the keyboard line coming from the printer.

Now, about those grounds. Remember that the keyboard must be isolated from the TTY loop. Also, the shift-pot circuit is constructed to work against chassis ground of the transmitter. You see, a ground by any other name is still a wire (or something like that). All those symbols mean is that the "cold" side of the keyboard, pot, and transmitter chassis are all connected together. You don't have to pound an eight-foot copper rod through your shack floor next to the Model 19!

While some are working on machines a score or more years old, others are looking at more modern devices. Such is the subject of a letter received from Robert LeMaster, Sr. WA9NZQ/5 over in Bentonville, Arkansas. Bob writes that he has searched high and wide for video RTTY systems to build that do not use

Fig. 1. One version of the "shift-pot" circuit.

a computer. He feels that he has no use for a computer and does not want to buy one just to use on RTTY.

Well, Bob, I'm not going to try to convert you to "computerism" here. We have talked at length in the past about the versatility one gains with a computer on RTTY. If you are interested in a "glass Teletype" only, several have been described in *73* in the past and are listed below:

"Build This Exciting New TVT," *73 Magazine*, March, 1976, p. 76.
"ASCII/Baudot With A Prom," *73 Magazine*, June, 1976, p. 114.
"A RTTY/Computer Display Unit," *73 Magazine*, July, 1976, p. 118.
"The XITEX Video Terminal," *73 Magazine*, December, 1978, p. 132.

I will point out, though, that by using a microprocessor-based system, you can gain a good deal of "smarts."

How about the ability to transmit and receive at several speeds, hold canned output in buffers, like a brag tape, and have the machine clean up your typing; all this is easy with a CPU controlling the station, very hard without it. Now, I am not talking about buying a $1000 system and tying it down to RTTY, nor am I thinking of buying a large system and using it occasionally on the air. An attractive alternative is to put together a small computer, on one board, with the program in permanent memory and a limited amount of on-board read/write memory.

Such a computer is termed a "dedicated" one, and can be put together very inexpensively. For example, a simple 6802-based system was described by Pete Stark in *Kilobaud Microcomputing* last year. The whole system fits on a small PC board. Write Pete at PO Box 209, Mt Kisco NY 10549, for details of the "Kilobaud Klassroom Komputer."

Ah, but you say, what about programming? Watch closely here in *73* and you soon shall see a super program, written for the 6800 (will also run in 6802 without modifications) which provides all the features a RTTY station needs. Requiring less than 4K of memory, it is designed for most 6800 systems using serial terminal interfacing via an ACIA.

Need more help? Scheduled to appear on the horizon very soon is a newly-updated edition of *73*'s *RTTY Handbook*. Containing all new material regarding RTTY equipment, this promises to become a new classic which belongs in every RTTY station. Among the new material will be video RTTY, both with and without a computer, along with new transmitting and receiving circuits, and a few bells and whistles. Watch for the announcement in the Radio Bookshop section of *73*.

Before I close this month, let me acknowledge a letter from Cal Sondgeroth W9ZTK, who writes concerning the program published in this column last July. Cal has taken a razor to the program and honed away sixteen bytes or so to make it more compact. Among his suggestions are to store variables on the 6800's Page 0, to allow direct addressing, and storing the START and STOP bits integral to each data byte. In other words, where I used "10101000" for the numeral "4", Cal would use "00101010." In his version, the bits are, reading from left to right, a "0" START bit, the five data bits ("01010"), a "1" STOP bit, and a "0" DON'T CARE bit. My order includes a "1" CASE bit, five data bits, and two DON'T CARE bits.

That CASE bit is needed to tell the program whether the character about to be sent is FIGS or LTRS, and to prompt the appropriate change of case, if required. I will grant that the one DON'T CARE bit could be used for the same purpose, but it seemed more general to store only the data and plaster the START and STOP bits externally.

The reason I did not use Page 0, by the way, is that this routine is part of a larger program, and most of that page is accounted for by other variables. In the practical system, however, Page 0 makes sense to use. It's just that here, as an example, I chose to use extended addressing.

Some reviews coming up in the next few months. I will try to sprinkle a few letters in here, too, maybe even a surprise or two! All for you, in RTTY Loop.

NEW PRODUCTS

BONE-CONDUCTION HEARING AID

Individuals with hearing impairments may soon be able to enjoy sound-oriented pastimes like ham radio by using a bone-conduction hearing aid developed by Matsushita Electric Co.

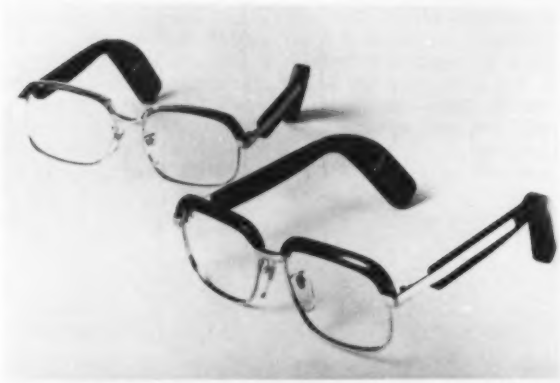
This electronic breakthrough bypasses the eardrum by vibrating the bones near the inner ear. A small microphone, amplifier, battery, and vibrating device are built into the frames of special eyeglasses. Matsushita plans to release this new hearing aid for the US market in the near future.

For more information, contact *Ruder and Finn, Inc., 110 East 59th Street, New York NY 10022.* Reader Service number 481.

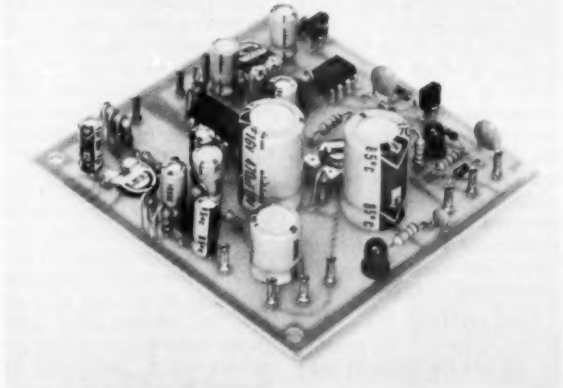
NEW HAMTRONICS® REPEATER MODULES

Hamtronics, Inc., long noted for FM transmitters and receivers commonly used for building repeaters, has now completed their line of repeater modules by offering inexpensive COR and CWID modules.

The 3" × 3" COR module kit contains an electronic relay to actuate the transmitter when the receiver squelch opens. Adjustable tail and time-out timers are provided on the board, as well as an audio mixer to combine the ID tone with the receiver audio for application to the transmitter. Another nice feature is a separate speaker driver amplifier stage which allows a local speaker to be operated completely independent from



Bone-conduction hearing aid from Matsushita.



Hamtronics® COR module.

the repeater audio level setup control, without using hard-to-find L-pads.

The 3" × 7" CWID module kit contains a tone generator controlled by a 158-bit diode matrix. Adjustments on the board control the ID speed, tone, and time. A special output filter eliminates the key clicks found on many repeater IDers. Although many articles have appeared recently on PROM IDers, many still prefer a diode matrix because it can be easily reprogrammed at any time without further expense. The CWID module is constructed on a double-sided PC board with plated-through holes for easy assembly. The CWID and COR modules are designed to be used with Hamtronics® transmitter and receiver modules as well as most other types. For further information, contact *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468; phone (716)-392-9430.* A complete 1981 catalog, which includes all Hamtronics® FM and SSB equipment, is yours for the asking. (For overseas mailing, please send $2.00 or 5 IRCs.) Reader Service number 477.

BILAL ISOTRON ANTENNAS

Isotron antennas, designed and manufactured by the Bilal Company, employ a unique new embodiment of a full-size harmonic antenna which permits the radio amateur who has limited space to get on the air from an apartment, condominium, mobile home, or other space-limited environments. There are no compromises in matching or tuning Isotron antennas to your transmitter. This unique design allows direct feed with standard coaxial cable and does away with the need for radials.

How is it that an eighty-meter antenna, for example, can be only four feet tall, eighteen inches deep, sixteen inches wide, and weigh a mere eight pounds... yet perform as well as a full-size antenna? Bilal claims that the answer is in research and development. Isotron antennas were five years in development and testing, and now are available in 80-, 40-, and 20-meter models.

For more information, call or write to *Bilal Company, Star Route, Florissant CO 80816; phone (303)-687-3219.* Reader Service number 483.

Continued

ETO ALPHA RF Power Amplifiers

ALPHA 76A Manually tuned, full coverage of 160 to 15m bands plus 1.8-2.0 and 3-22 MHz; includes new WARC bands. (2) 8874 ceramic-metal grounded grid triodes. 2.5 KW PEP-SSB input, 1 KW average, CCS - No Time Limit. Drive power nominal 60 watts carrier, 110 watts PEP SSB. 120/240 volt 1.5 KVA heavy duty transformer, quiet forced air cooling. 7½"h × 17"w × 14¾"d, 65 lb.

Regular $1865 - ***Sale Price $1499***

Option "L" Lightweight Hipersil® transformer reduces weight 20 lbs, no change in ratings ..... ***add $160.***

ALPHA 76PA Identical to 76A except uses three 8874 final tubes. Recommended for FSK and SSTV operation where extended key-down time is necessary.

Regular $2195 - ***Sale Price $1799***

ALPHA 76CA Same as 76PA, but uses 2.4 KVA Hipersil® extra-duty transformer for rugged, heavy duty use or tough environments; reduces weight by 10 lbs.

Regular $2395 - ***Sale Price $1999***

ALPHA 374A Adds "no-tune-up" convenience to the basic 76A chassis. Provides instant bandswitching among the popular amateur bands, plus full coverage manual tuning in the 1.8-2.0 & 3-22 MHz ranges.

Regular $2395 - ***Sale Price $1999***

ALPHA 78 Combines the best features of all other ALPHA amplifiers. (3) 8874's, QSK, 2.4 KVA Hipersil® transformer and a bandpass no-tune-up system that fully covers the 160-15m bands with no sacrifice in efficiency compared to manual mode. 7½"h × 17"w × 14¾"d, 65 lb.

Regular $3185 - ***Sale Price $2599***

ALPHA 77DX Manually tuned, full coverage of 160 to 15m plus 1.8-2.0 & 3-22 Mhz; includes new WARC bands. Power output 2 KW PEP-SSB or or continuous carrier. DC plate input rating is 3 KW PEP or continuous carrier - No Time Limit. Single 8877 ceramic-metal grounded grid triode, requires 100 watts drive for 2 KW input nominal, typical efficieny better than 60%. Vacuum relay QSK-T/R system, air cooled, encapsulated 4+ KVA Hypersil® transformer, heavy duty silver plated tank coil & ceramic vacuum variable plate tuning capacitor. 120 or 240 volt primary. 11"h × 19½"w × 22"d, 103 lbs. Air Freight.

Regular $4945 - ***Sale Price $3999****

***Drop-shipped from factory via Air Freight - Freight Collect (F.O.B. Colorado).**

- or -

Regular $4945 - ***Sale Price $4149*****

****Picked-up or shipped via Air Freight - Freight Collect from one of our stores.**

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Benjamin Michael Industries' military-time clock.

The Heath μMatic Memory Keyer.

MILITARY-TIME CLOCK

Benjamin Michael Industries, Inc., has announced the addition of the Model 173DM to its line of professional military-time-format clocks.

The 173DM features dual, independent digital clock circuits housed in a solid walnut case. The unit is suitable for placement on any desk, communications console, briefing table, etc. Military time is displayed on the left clock face while standard 12-hour format with AM/PM indicators is used on the right. Each clock is independently set, allowing display of different time zones if desired. This arrangement makes the 173DM ideal for applications requiring the use of both Universal Coordinated Time (Zulu) and local time.

Both large displays are of the LCD type for excellent visibility and ultra-low power consumption. The 173DM features quartz-crystal accuracy and over one year of operation on a single, readily-available battery. The absence of a power cord makes the unit ideal for desk-top use and eliminates the need for resetting after commercial power failure.

For more information, contact *Benjamin Michael Industries, Inc., 65 E. Palatine Road, Prospect Heights IL 60070.* Reader Service number 480.

UNIQUE MICROPHONE SYSTEM

Mobile operating will never be the same! Daiwa's RM-940 brings the total freedom of cordless operation with a lightweight, compact microphone, infrared sensor, and control/charger unit.

The electret condenser microphone can be hung around the neck like a pendant (cord supplied), or conveniently clipped to a shirt pocket. A latching push-button switch activates the tiny infrared transmitters on the microphone. Audio and transmit/receive switching are then transferred via infrared beam to a sensor mounted near the sun visor or the rearview mirror. The maximum usable distance is 3.5 feet. An additional sensor can be added for broader coverage.

Infrared microphone system from MCM Communications.

The control/charger unit features Velcro pads for easy mounting and microphone plugs compatible with most Kenwood, Icom, or Yaesu rigs (specify when ordering). Other plugs can be installed to suit particular needs. A maximum of eight hours of charging time will provide a minimum of five hours of continuous use. The control/charger unit also provides a visual (LED) and audible (soft beep) indication whenever the microphone is switched on. Optional microphone wind screens are available. For more information, contact *MCM Communications, 858 E. Congress Park Dr., Centerville OH 45459.* Reader Service number 478.

HEATH'S μMATIC MEMORY KEYER

Reports say a sneak preview of the new Heathkit® SA-5010 μMatic Memory Keyer created much interest at the 1981 Dayton Hamvention. The keyer is now featured in the latest Heathkit Catalog from Heath Company.

Described by a Heath spokesman as compact and modern in styling, the SA-5010 uses a custom microprocessor to provide up to 10 buffers for storing up to 240 characters of text or commands. These variable-length buffers eliminate wasted memory space by letting the user store text in several buffers and then string them together in any sequence. Command strings also can select the speed, weight, spacing, and auto-repeat count for each message so selected. This feature is said to make the μMatic so versatile that Heath has applied for a patent on it.

The SA-5010 employs a 20-position keypad for entries, and features easy-to-use integral capacitive "touch" paddles. A rear panel jack is provided for use of a mechanical paddle, if so desired.

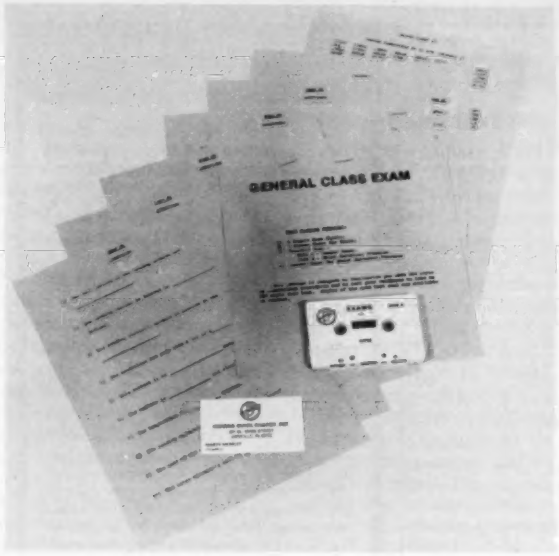
A "practice" mode sends random code groups of random length and selectable types. The 100 different random sequences are repeatable, so the ham can check copy for accuracy. All 100 sequences are altered each time the keyer is turned on, to give a total of 6,400 different practice sessions. Each sequence sends approximately 3,000 characters before repeating. The user can choose any speed between 1 and 99 words per minute, and any of 11 weight settings.

CMOS memory with battery backup is said to retain the buffer contents, as well as the last-selected speed, spacing, weight, and repeat count whenever the keyer is turned off or unplugged.

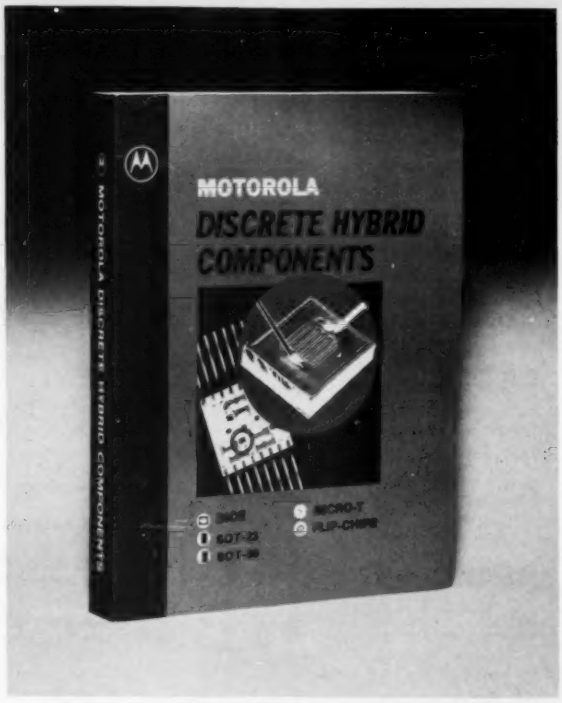
Built-in diagnostics check the microprocessor each time the keyer is turned on, and also test buffer memory whenever the μMatic Memory Keyer is reset. For the left-handed CW operator, a special two-key function reverses the paddles. The keyer even remembers to turn itself off if the user forgets!

The SA-5010 features built-in sidetone oscillator and speaker with variable pitch and volume controls. Phone jack and ear phone are included for private listening. A plastic case covers the die-cast zinc base, which is weighted to reduce movement during keying. The keyer requires the optional 120 V ac Heathkit PS-5012 power supply. Step-by-step instructions make this a two-evening kit.

The SA-5010 μMatic Memory Keyer and nearly 400 other



The Indiana Quick Charge CW exam package.



Motorola's Discrete Hybrid Components catalog.

build-it-yourself electronic kits are featured in the latest 104-page Heathkit Catalog. For a free copy, write *Heath Company, Dept. 350-115, Benton Harbor MI 49022.* In Canada, write *Heath Company, 1480 Dundas Street E., Mississauga, Ontario L4X 2R7.* Reader Service number 485.

CW EXAM PACKAGE

Indiana Quick Charge, Inc., has recently completed a Morse code practice package for the new-style FCC exams. The package consists of five completion-style exams, two answer sheets, and one cassette tape. The A side of the tape has five segments of text, each approximately five minutes long. The B side has mixed characters practice ranging from a little below the test speed and gradually working up to the speed desired. Each sample test is on a separate sheet, with an answer key for all the included sample tests. The cassette is well produced, with excellent keying characteristics. All the text and mixed characters are computer-generated, assuring evenness and accuracy.

Designed to test the user's readiness to take an FCC code exam, it should be stressed that the text included is composed, and is not a word-for-word copy of any actual FCC tests. It is similar only in style and length, and is intended to test the skill and ability of those who are preparing to take the actual test. Two packages are currently available: the General class practice at 13 words per minute and the Extra class practice at 20 words per minute.

For more information, write: *Indiana Quick Charge, Inc., 367 West Main Street, Danville IN 46122.* Reader Service number 479.

UHF ALL-MODE AMP

The D1010 amplifier is a solid-state all-mode amplifier designed to be used in the 430-to-450-MHz amateur band. It will amplify a 10-Watt signal to more than 100 Watts output; 2 Watts input produces 25 Watts output. The D1010 can be keyed with as little as 300 milliwatts. This makes it a versatile amplifier for all low-power transceivers and HTs. The D1010 is biased as a linear amplifier, therefore, it will amplify FM, SSB, CW, and ATV signals.

Other features include remote operation with the optional RC-1 remote head, external or internal keying circuitry, over-temperature protection, and the typical rugged packaging that is a part of all Mirage products.

The D1010 carries a 5-year warranty on all parts except the rf power transistors which are warranted for 1 year.

The D1010 will be an asset for any station, whether on OSCAR, mobile, remote base, or SSB/CW DX.

As with all Mirage products, they are only available through their worldwide dealer network. For further information, contact *Mirage Communications Equipment, Inc., PO Box 1393, Gilroy CA 95020.* Reader Service number 476.

HYBRID COMPONENTS DATA BOOK

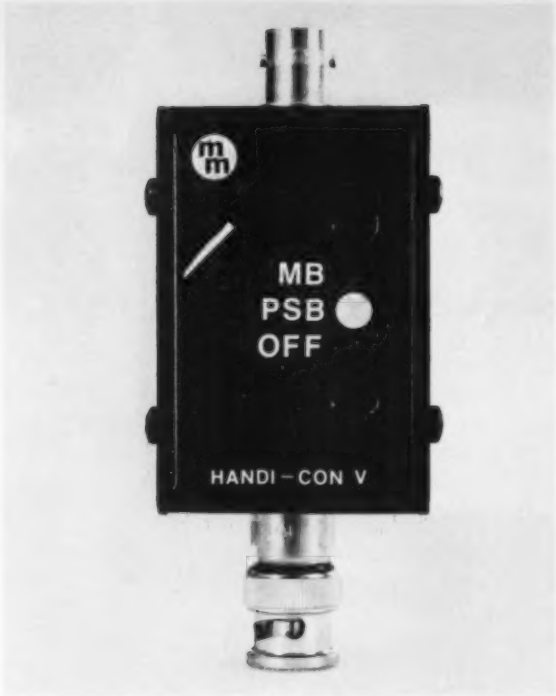
A new data book detailing the specifications of discrete semiconductor components has been published by Motorola. The new Discrete Hybrid Components Data Book covers 10 different discreet-product categories, including a variety of transistor, diode, thyristor, and optoelectronic lines, and includes five different packaging methods: standard chips (dice), flip-chips, Micro-T™, SOT-23, and SOT-89.

The book includes an easy-to-use cross-reference between standard discrete packaged devices and equivalent unencapsulated chips, and provides both electrical and physical data for each of the chips.

All Hybrid components described in the Data Book are available from Motorola or through authorized Motorla Hybrid Components distributors.

The Motorola Discrete Hybrid Components Data Book is avail-

Mirage's all-mode 100-Watt UHF amplifier.



M-Squared Engineering's HT receiver coverage expander.

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For more information contact *M-Squared Engineering, 1446 Lansing Ave., San Jose CA 95118; phone (408)-266-9214.* Reader Service number 482.

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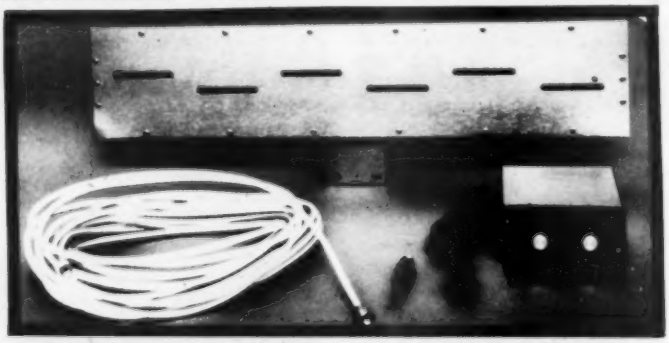

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HEATH SB104A See "Ham Radio", April 1981
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LETTERS

HOLLOW WIN

Today, I received word from Bill Gosney, your Contest Editor, that I had been disqualified from *73 Magazine's* 1981 160-Meter Phone Contest due to excessive power output from my station.

First, let me say that I was not surprised and, second, that I plead guilty! But how, you might ask, did the contest committee come up with this information? Here is how.

After recopying my log sheets, duping, and finalizing my contest results (910 QSOs/400,000 points), I came to a paragraph on the summary sheet that required my signature. I had to swear that I had abided by all rules and regulations of *73 Magazine* and the FCC. Well, I could not bring myself to sign it because during the contest I used the homebrew linear (4-1000) that I had completed the day before the contest.

I know that if I had made my own summary sheet instead of using *73*'s, I could have avoided that hurdle like most of the other guys did, but I could not. Instead, I contacted Dan Murphy WA2GZB, the contest chairman, and informed him of the situation. He advised me to go ahead and send my logs into him, anyway.

I also told him that, in my opinion, everyone who had done really well in the contest also had used an rf amplifier of a power equal to mine. Dan acknowledged that he was aware of that fact and said those guys were not as honest as I in admitting to using an amplifier. I call these people hypocrites because they tell people they are using legal power and that their antennas are doing a spectacular job.

During the contest, my signals were never louder than those of some of the other big boys. Don't you find that interesting? I don't know of one contest station I have visited that did not have a 160-meter amplifier. Why all the secrecy? One has to use an amplifier on 160 during a contest to be competitive because everyone (or almost everyone) does. I would like to add that I did not use an rf amplifier before the LORAN shutdown in early January. I wonder how many other contesters can say the same thing.

I knew that I would be disqualified when I made these admissions, but I feel that about 90% of the other guys in the contest also should be disqualified or should at least have the guts to disqualify themselves.

Willy Worth WB3GCG
Brandywine MD

I admire your honesty, Willy. It's too bad you didn't let your conscience be your guide before the contest as well as after.

As a contester, I cannot understand what fun it is to win by violating the rules. To my mind, an operator who plays the game that way is no better than a small-town bully; he always gets his way, but so what?

A hollow victory is no victory at all.—Jeff DeTray WB8BTH.

NOISE-BRIDGE CORE

I am writing to point out a small error in your otherwise excellent article on the noise bridge ("QRM-Free Antenna Tuning, August, 1981).

The Indiana General core specified is made in a number of different ferrite "mixes" and you must specify which one you want. The commonly used one is the Q1 mix.

Also, Indiana General has changed their numbering system, so the CF-102 is now known as the F625-9. Thus, one should ask for F625-9 in Q1 mix.

If you order from Amidon, you should specify an FT-37 core with 61 mix if you want a core just like the F625-9 in Q1 mix. Are you confused by now? The T50-2 is an iron-powder core and, in my opinion, would not be as good as ferrite in this application.

Another way to get the proper core for this transformer would be to order from Palomar Engineers and ask for their F-37-Q1 core. This is exactly the same as the Indiana General F625-9 in Q1 mix. Send 60¢ each along with $1.50 per order shipping to Palomar Engineers, 1520-G Industrial Avenue, Escondido CA 92025.

Jack Althouse K6NY
Palomar Engineers

NOTES ON FLYING

In reference to "A Flier's Guide to the Airways," August, *73*, I have been an admirer of Jim Weir and the RST Company ever since its founding—a truly outstanding and innovative operation.

I do have a couple of nit-picks, however. First, one does not become aeronautical mobile until one is outside the limits of the continental USA. Otherwise, you are air mobile or simply mobile. By the same token, one does not become maritime mobile by being in a rowboat with an HT in a local lake.

Second, the article must have been in the editor's in-basket for a number of years [Are our faces red?—Editors]. Aviation gasoline now costs about $2 per gallon and the aircraft mentioned in the article would use at least $15 worth of fuel per hour.

The article was very useful to me because I had never heard of the Advisory Circular 20-98.

One problem Jim did not mention involving air mobile operation is noise. Most cockpits present a very noisy environment and the average microphone just can't cope with it. Even many of the "noise canceling" mikes don't hack the program. I use a Turner "Road King 50 Trucker's CB Special" and it is so effective that most people do not realize that I am in an aircraft (a noisy Mooney). Unfortunately, this microphone has been out of production for some years. If you see a used one, grab it.

Ken Hargrove W4OQP
Orlando FL

Thanks for the clarifications, Ken. Seems inflation has caught up with the magazine business in more ways than one.—Editors.

A PHOTON TORPEDO

I take exception to the theory put forth by W4FD and W4ATE (July, 1981, p. 52) that photons of light constitute the medium through which radio waves propagate. The theory sounds somewhat plausible, but has one major deficiency. Namely, if radio "waves" need some sort of medium to travel in (such as an "ocean" of light photons), then what sort of medium exists for the propagation of light "waves"?

Perhaps, the authors would suggest that since radio waves travel through light waves, then light waves must travel through X-rays and X-rays through gamma rays. In other words, perhaps there is an infinite succession of media, each having a shorter wavelength than its predecessor. But this is impossible, because the energy of photons increases as their wavelength decreases. An infinite series of media would require an impossible amount of energy.

The authors apparently would like to ignore the fact that light photons often behave like waves. Light has definite wave-like properties which easily can be demonstrated with a lens or diffraction grating. Now since a "wave" is usually interpreted as the propagation of some sort of "disturbance" through some sort of "substance," it is "logical" to assume that space is filled with some sort of "aether" which transmits "light vabrations." Of course, no such substance has ever been discovered (except for the ocean of photons proposed by the above authors).

Perhaps, the authors then might suggest that light waves are propagated merely by virtue of their particle-like properties alone. If photons are really particles, then they can travel through a vacuum without any assistance from a "medium" at all. We simply will ignore their wave-like features. But if this is true, then we don't need the authors' theory at all, because it turns out that radio waves also consist of photons and therefore would not require a "light-assist"! Radio and light are the same form of energy. The fact that radio photons have longer wavelengths has no bearing on the matter.

I also take exception to the authors' implication that a photon has a rest mass "as does any solid." The man who discovered the photon (Albert Einstein) proved that a photon cannot have a rest mass be-

cause otherwise it could not travel at the speed of light. A photon does have energy and this energy can be equated to mass by the famous $E = mc^2$ equation. Therefore, the more energetic a photon is (i.e., shorter wavelength), the more mass it will appear to have.

This apparent mass can be observed in such phenomena as the solar wind, as the authors correctly pointed out. But photons do not exhibit mass properties such as elasticity or rigidity, which are necessary for the transmission of vibrational energy through a physical medium.

John C. Day
Ormond Beach FL

That's easy for you to say!—Editors.

KUDOS

I was quite pleased to see a review of *The Radio Amateur's Conversation Guide* by the two very competent Finnish linguists OH2BAD and OH1BR in your July, 1981, issue. I previously had read of this book and its authors in the NRRL magazine, *Amatorradio*. In defense of the lack of a pronunciation guide in the book, I would like to make the following comments.

Given the international scope of this book, it would be almost impossible to give pronunciation guides in agreement with everyone's language. I will agree that there is a need for such a pronunciation guide, a need which could have been answered by use of the International Phonetic Alphabet (IPA). However, not everyone is familiar with the IPA, and extra pages would have been spent to explain the numerous phonetic symbols in each of the languages represented in the book. The availability of the cassette, therefore, is a much easier and more readily accessible answer to the need for a pronunciation guide.

Realizing fully that most Americans are considered almost as linguistically ethnocentric as French Quebecoises, the appearance and hoped-for acceptance of such a work as *The Radio Amateur's Conversation Guide* is heartening, to say the least.

The age-old myth of the difficulty in learning a second language is easily dispelled by the simple truth. Each of us had learned the essentials of one of the world's most notoriously confusing languages before any of us had learned to read or write. Adding another language is a simple matter of concentration, the same concentration that we all use to learn the International Morse code.

In passing, I might also add that Jukka and Miika Heikinheimo are both accomplished linguists. Miika is a scholar of ancient languages and theology, and Jukka, who studied Russian and Spanish at Helsinki University, operates a translation bureau, complete with computerized text processing equipment. Both are to be congratulated for this excellent book.

Nils R. Bull Young WB8IJN
New Carisle OH

Si Hablo dit-dit?—Editor.

MULTIMETERS

After reading your "*73 Magazine* Staff" article titled "Maximize That Multimeter" in the June issue, I feel compelled to write and give my feelings about some bad ideas expressed in this article.

First of all, a plastic meter case could render the unit worthless in the presence of typically encountered rf levels.

"Multimeters" generally do not have the need for three leads, but virtually all VTVMs do. The constant input resistance of VTVMs allows for the convenience of the important isolation resistor. A VOM, because of its input resistance change with range change, doesn't have this facility. For this reason, a VTVM is necessary for dc voltage measurements with the presence of a signal. The VOM without the isolation resistor tends to drastically affect the circuit impedance (especially video and rf circuits, but high-impedance hi fi amp circuits are not immune). Rf getting into the VOM tends to be rectified by the commonly-used meter-protection diodes, causing erroneous readings. In our studio, a Simpson 260 VOM lying on the service bench will give a half-scale reading when the leads are inserted but not connected to a circuit.

At the transmitter, we have found that a VTVM with a 100-megohm resistor in place of the 1-megohm original has both given the scale a $\times 10$ factor and made it entirely immune to the presence of rf around the 5-megawatt ERP transmitter.

Using a meter which has a 1.5-V cell to power the ohmmeter section *may* produce enough voltage at the probes to turn on a silicon device, but does not do so for all conditions. For example, the full 1.5 V occurs at the probes only for infinite resistance, but at zero Ohms the voltage is zero. The amount of voltage at the probes is between zero and the 1.5 V as measured on a linear scale having 0 V at 0 Ohms and 1.5 V at infinite Ohms. A VTVM is the best meter to first visualize this relationship on. Therefore, simply use an ohmmeter range which gives a reading with less than about 0.25 V across the probes, and silicon devices are not turned on. The accuracy of this method is good enough for 99% of your service needs.

Franklin E. Swan W9SIA
Chicago IL

TORTURE

Concurrent with the ongoing debate about dropping the code requirement for a ham license, the media recently recounted an interesting story about one of our Vietnam POWs who used code to communicate with the outside world in an unusual way. To verify that the story is true, I wrote to the Honorable Jermiah A. Denton, Jr., now a Senator from Alabama, and he did indeed blink out "torture" with his eyelids while making a forced TV interview. A copy of his reply is attached.

Dear Mr. Crom:

I sincerely appreciate your comments of June 24, and am glad to respond to your request for my views on the Morse code requirement in FCC licensing of ham radio operators.

The FCC, as you are probably aware, has 2,400 personnel with which to supervise every facet of communications in the USA, with only 450 of these in the field. Rigid rules and reliance on self-policing from other operators are both logical and necessary.

Requiring proficiency in Morse code is one way, a good way—an economical way—to maintain both quality and discipline in what could quickly become a nightmare in amateur radio operations. In my particular case, had I not known Morse code, I would have been denied the one viable option of communication open to me while a prisoner of war, so I am definitely in favor of it.

Jeremiah A. Denton, Jr.
United States Senator
Washington DC

It is hoped that this incident will help motivate others to put in the little extra effort that will help keep ham radio from becoming an extension of the CB mess.

Russell C. W. Crom AG9N
Mt. Prospect IL

BEING POSITIVE

After being a subscriber and reader for quite some time, I thought I would drop a note to you and tell you how much I enjoy both your editorial and also your magazine. I always read your editorial first, followed by Awards, Leaky Lines, and Looking West. Keep socking it to those Connecticut "good old boys," Wayne. At least you seem to remember from week to week where you have drawn your lines.

I don't know if you still plug dealers in your magazine but if so, please log up a couple of gold stars for the Electronic Center in Lincoln, Nebraska. I acquired a Kenwood TR-7800 from them at a recent hamfest in St. Paul. The nicads used for memory retention would not charge. I called them up on their toll-free number and they advised me to send it to them. I did so and had it back in 12 days fully operational. Their tech claimed pilot error for the malfunction, but whatever the reason, it works fine now.

Bob Cronberg KB9XR
Plymouth MN

Wayne, Bill, Dave, and Bill appreciate your pat on the back, Bob. Any fans of our other columns out there?—Editors.

MR. DX

I would like to express how much I enjoy the new DX column by Yuri VE3BMV. This is not the kind of DX column that I am accustomed to reading in any other monthly ham radio magazine.

His column has real information that can be used on the air, up-to-the-minute info on the rare ones, and great operating aids for the DX hunter. It is obvious that Yuri has a great deal of knowledge of DXing, and is not reluctant to share it with us.

I look forward to this valuable addition to *73 Magazine*. You fellows at the front office have really snagged a rare one by getting Yuri.

Ron Brown WA3CEC
Dundalk MD

Sh-h-h-h! We don't want Yuri to get a big head.—Editors.

BOHME?

In your editorial in the July issue of the magazine, you mentioned possible implemenation of types of high-speed communication. I have had some experience in Bohme, which at the time had capability of 600 wpm. This was in 1943 when I was CO of WVNT, the hub of Signal Corps communication in the Middle East.

It is my belief that this was the first time the Signal Corps attempted to operate their own 40-kW point-to-point station outside of the USA. The location was Asmara Eriteria, elevation 7600' above the Red Sea port of Massowa, and 65 miles by road from there. The station was fitted with punched tape (Kleinschmidt, or Bohme) transmitter heads, and the receivers were located 6 miles away with triple diversity operation output back to transmitter location where the tapes were made for retransmission via Manual Station to Cairo, the Persian Gulf, and other stations. We also handled all communication for the operations in north Africa until the invasion of Oran and Algiers, when a similar station was set up there (Algiers).

Today, with solid-state equipment (Hal) I find that 200 wpm is possible, and understand that printers are available commonly to 600 wpm. My Hal equipment will print (on monitor) 300 baud, 30 characters/second, or 1800 characters/minute, or 360 words/minute. This is not bad for starters. I have experimented personally with 100 to 150 words/minute. I am going to try to work out something with a friend who has the same equipment I have, and will report results.

I would appreciate any feedback that can come about as a result of this work, I have a kW to a 20-meter dipole and about 600 W possible on 15 and 40 meters where, unfortunately, few RTTY stations operate. I have not tried 75 meters, where I have heard some operators.

Henry B. Plant W6DKZ
4160 Holly Drive
San Jose CA 95127

CW at 200 wpm? It's a good start, but we can do even better. Let's get some reliable 1200-baud ASCII systems working. The FCC seems receptive to STAs right now. Don't forget to write it up for 73.—Editors.

KAHANER REPORT

Larry Kahaner WB2NEL
PO Box 39103
Washington DC 20016

FOR WHOM THE BELL TOLLS

AT&T and the Bell operating companies no longer have the only wheel in town. You've seen the commercials for a company called MCI: "You haven't been talking too much, just paying too much!" MCI, a company which didn't exist until several years ago, offers a cut-rate long-distance service which pushes AT&T long lines out of the picture.

The system is ingenious but at the same time simple. You dial a local access number (5 digits); when you hear the beep, you enter a 6-digit code number (that's so they know who to bill the call to), then the area code and phone number you want.

The call is routed from the local access number through a network of microwave relays until it reaches the final destination area. Then the call connects back into the local phone network and your hookup is completed.

As I said, simple. Ma Bell is cut out of the action except for the two local calls.

AT&T tried to keep MCI from skimming the cream off the long-distance business, wouldn't connect their network, and generally made life miserable for the company. MCI took them to court and won a whopping $1.9 billion. AT&T is, of course, appealing the decision.

Don't get me wrong. AT&T did have reasonable grievances about the new kid on the telephone block. AT&T invested in an entire network, local and long distance, and MCI is taking the most lucrative part away. It's difficult sometimes to feel sorry for a monopoly which racked up a $6-billion profit last year, but they do have a point.

Anyway, MCI is doing very well. 1981 fiscal year net income totalled $21 million.

Ironically, they're still not happy. They don't want their customers pressing so many buttons. They want you to hook directly into the local phone loop without all the fingerwork.

AT&T maintains it isn't possible. MCI says it is, and they proved it. MCI cut a deal with a small independent telephone company in northwest Iowa—Northwest Iowa Telephone. NIT's 2,100 customers in three Iowa cities have an equal choice between dialing via AT&T or MCI.

If a caller dials "6," then the 10-digit long-distance phone number, he goes MCI. If he dials "1," then the 10-digit long-distance phone number, he travels AT&T. Service was expected to begin Aug. 1.

MCI President Bill McGowan told a group of reporters, "AT&T could do this for us, but they don't want to. AT&T argued that it couldn't be done, but this agreement proves otherwise."

One funny note in all of this: The agreement was broached by the small telephone company to protect its interests from MCI which was planning facilities in Sioux City, an area partially serviced by NIT. MCI would have siphoned off some of the long-distance revenue which AT&T kicks back to the local operating companies. MCI, which used to fight the big bully, was, in this case, a bully itself.

And a footnote—Why did MCI choose the number "6"? Well, because it corresponds to the letter "M" for MCI!

Okay. So MCI—and to some extent Southern Pacific which operates the SPRINT system—have installed networks to replace long-distance service. Bell still has the local loops, right? Yes, but even that's up for grabs. It began about five years ago when Xerox proposed something with the space-aged name of XTEN. It was to be a local digital network, mainly for high-speed data traffic to and from major metropolitan areas.

This was the plan: Xerox was going to install a centrally-located microwave dish on the tallest building it could find. (The second tallest would have worked, too.) Then on your office building, you install a microwave dish which feeds data from you (by way of a network inside the building) to the central dish. The data is then sent via satellite or AT&T long lines. You bypass the local phone company, which can't carry high-speed data in most cases, anyway. Of course, you're not the only one using the system; others in your area are doing the same thing, using dishes on their buildings. Xerox envisioned a mini-network feeding into one, possibly two, central points.

Xerox convinced the FCC that this was such a good idea that the Commission authorized DTS, Digital Termination Service, in the 10-GHz range. Xerox couldn't be happier. After all, they were the only ones thinking of such a thing, and they expected to clean up.

Well, things got a little out of hand. Management appeared unstable; changes were made. In short, way behind schedule and a couple of bucks behind, Xerox dumped XTEN earlier this year.

But alas! Another company (named ISACOMM) has jumped into the scene and asked the FCC for permission to offer a similar service.

Local users, once they connect via microwaves to the central point, will have their messages transmitted by satellite to

users in other cities with the same setup. Not only is AT&T out of the long-distance action, but out of the local action as well.

ISACOMM is owned by Insurance Systems of America, a consortium of insurance companies. The reason why they backed the network seems clear. Insurance companies must move lots of high-speed data quickly and cheaply.

But ISACOMM isn't stopping there. According to the filing, the firm plans videoteleconferencing, voice, and other services. Although the intent, at first, is clearly to serve its backers, it may, one day, expand to the consumer.

The initial plans call for the linking of 30 cities. The first central site is Atlanta.

So, what have we got here? Competition for AT&T and the local Bell operating companies for the very first time.

Don't ask for whom the bell tolls, Ma Bell. It tolls for thee.

JUST FOR THE RECORD

The FCC has added some new commissioners: Henry Rivera, a New Mexico lawyer, and Mimi Dawson, a congressional aide. This complements the full commission, consisting of Chairman Mark Fowler, James Quello, Joseph Fogarty, Abbott Washburn, and Anne Jones.

In a personnel change more directly affecting hams, we learned at deadline that Carlos Roberts, chief of the private radio bureau, was planning to leave at the end of August. He was offered a job as director of land mobile development for M/A Com Labs in Gaithersburg, Maryland. You may know M/A Com as the parent of Microwave Associates, a firm that sells microwave gear for amateur use.

His replacement will be James McKinney, now chief of the field operations bureau. McKinney is well respected and has always held ham radio in high regard. On several occasions, at FCC meetings, McKinney has called amateurs the best disciplined group that the Commission manages. Maybe he hasn't listened to 80m lately, or perhaps his 2m rig is on the blink. Or maybe, just maybe, compared to everyone else, we're tame. That's a scary thought.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

right outside the back door of the room. Chuck and Tim quickly put up an antenna and were batting 'em out on 15 meters. I was able to get in edgewise and operate, but most of the time the band was open to Europe instead of the US. I didn't find the pileups that I did when operating from Turks and Caicos Islands.

The next morning we had an appointment with the Prime Minister of the country. He wanted to thank me for sending Tim down last year with the four trunks of ham gear to help them after the hurricane. That was the worst hurricane the island had had in a hundred years or so. It wiped out most of the banana crop, demolished hundreds of buildings, and screwed things up for a long time to come.

This gave me an entry to talk about the possible development of ham clubs on St. Lucia to get teenagers interested in amateur radio. The PM was very interested in this and I think we may be able to get that started. The idea is simple... interested hams or clubs in the US could provide the funds for club stations to be set up in youth centers in St. Lucia. Their government would provide someone to teach the fundamentals of electronics and radio, while the students learned about operating by running the club stations. Thus, the youngsters would get the enjoyment and enthusiasm of being able to operate while they are learning the basics of radio. With this grounding, the teenagers would have a head start toward technical careers in electronics or communications. Technical people are needed desperately in small countries such as St. Lucia.

This plan is similar to the one I outlined for Jordan and which got their youngsters started in careers in electronics.

If any hams or clubs are interested in helping this project, I think we can furnish a first-rate club station for about $1,500, buying the equipment at wholesale. Part of the bargain is an opportunity to make a visit in a year or two and see the hams which your station has developed. I would like to have as many hams as possible share the thrill I had when I visited Jordan and had a chance to meet the hundreds of young hams which my first visit had brought about.

St. Lucia has an advantage over most countries in that there is no duty on ham equipment. Canada managed to cost itself millions of dollars in lost technicians and engineers by putting a heavy duty on ham gear. Indeed, there are many countries where just the duty alone on a small rig is more than the average educated local earns in several months. I'm not talking about a sideband rig—just a simple CW transmitter. I remember talking with a ham in Egypt who had to spend four months' wages to import a ham rig sent to him by an enthusiastic American ham. It *could* have been done at less expense if the American ham

That's the Prime Minister talking with me... with Tim to the right of me and Chuck to the left side of the picture.

The small and crowded streets of Castries on St. Lucia are jammed with traffic much of the day... just like New York. The pace of life there is slower and the prices more reasonable. Note the lady with the bundle on her head. Most of the cars were Japanese... with some Russian versions of the Land Rover growing in sales.

had sent it in pieces, but even so, the duty would have been painful.

St. Lucia is a wonderful place to visit, but I discovered that a visit can be dangerous. I found several Americans living on the island. They came down just for a visit, found out about the low cost of living there and the beauty of the island...and moved down. I understand that one can rent a small house on St. Lucia for about $100 a month. And, while most of the bananas are exported to Britain, you can live economically on local foods.

By the way, bananas grow quickly, so the devastation of 1980 was already just a memory. Each time a banana plant grows and provides its bananas, it is cut down and a new plant grows from the roots. Fresh pineapples, coconuts, mangoes, papaya, sugar apples, and so forth are growing all over the island.

The hams on St. Lucia reflect a wide area of interests. One runs the electronics store in Castries, the main town. Another is a lawyer. Another runs the yacht club (and issues the ham licenses).

We were taken on a trip around the island, all the while in touch with most of the active hams via the .34/.94 repeater. This was a beautiful trip, showing us the dry, the rainy, the mountains, and the flatlands which make up this small island. It's about 40 miles from one end to the other. I hope you'll get a chance to see my slides.

On the southern tip of the island, we went to the top of a mountain and I had the kick of working a chap who was visiting Barbados. Not bad for a 2m hand transceiver.

We enjoyed meeting the businessmen of St. Lucia at the Rotary meeting, and the hams got together for a big cocktail party, complete with marvelous snacks...and Miss St. Lucia, the recent winner of the island beauty contest.

None of the hams was into scuba diving, but they did take us to St. Lucia Divers, where Chuck, Tim, and I arranged for a dive trip. Actually, Chuck and Tim went snorkling while the divemaster and I went down with scuba gear. I had along my camera and a new flash unit, and snapped pictures until the film was done. The dive spot was beautiful, even if it was about 20 miles down the coast from Castries...a long, bone-jarring boat ride. The underwater scenery was great for both snorkling and scuba, with a headwall going down sharply for the adventurous. There were plenty of gorgeous coral formations and colorful fish.

After the dive, we packed up and went a boat-banging twenty miles back to Castries. I think the ride was more exhausting than the dive. Anyone with a tendency toward seasickness should not make that trip. Sherry wisely opted to hear all about it later. She'd made a similar trip with Chuck and me at Turks and decided not to go through that again. The next trip to St. Lucia, I think we'll stay at the hotel right by the diving spot...near the town of Soufriere.

The four-day extended weekend "vacation" was over all too soon. Our hosts picked us up at around 6:00 am and drove us the hour and a quarter to the airport and we were on our way. The plane stopped for a few minutes at Guadeloupe, but they wouldn't let me off to collect one more country visited.

We soon were back in the air with the next stop St. Croix, where they have an international airport. Here, we had to get off the plane and go through US Customs. I declared the only thing I'd bought...a straw hat. On the next hop, we flew over Puerto Rico, where I was able to take a long shot of the disk at Arecibo, and then on up the islands. We went right over Providenciales, where we had visited in March, and I took a picture of the Bob Cooper estate and TV receiving dish. Soon we were in Miami and then on our way to Washington...and Boston.

Speaking of Miami, on our way down to St. Lucia we had to stop there. We were met by two good friends of Tim's, Don and Mary Johnson, who took us for a visit to N&G Electronics...and a Mexican lunch. They made the stopover between flights a fun time. I was particularly impressed by the N&G store and the amount of ham gear they have in stock. They showed me the plans for their new store, which they will be starting on soon. It will be in the same general area, not far from the airport, but will be much larger. A good deal of their business comes from Latin America.

Outside of a short DXpedition to Swaziland and Lesotho in August, I had nothing much planned for a while. Those countries were to take me over the 100 mark in countries visited. Should I start working for 200 or just settle down and take it easy? I was on the air from both of them, as well as South Africa.

INFORMATION STATIONS

At long last, microcomputer technology is beginning to really get involved with amateur radio. There is no question in my mind but that it is going to take over and amateur radio will never be the same.

You've probably at least seen pictures of the Radio Shack pocket computer. Well, this is not a very big computer, but it is a decided development over the pocket calculators. It has a small BASIC language built in, so it can be programmed to do almost anything...and that includes some word processing.

A recent development in this line is the new Casio pocket computer (FX-702P)...a six-ounce computer with a five-pound manual. This, along with the Sinclair ZX-80, which is selling for $150 to $200 most places, could be mated with a ham rig to provide a sort of instant message service. Let me go into that in more detail.

Those of you who are already busy with microcomputers are aware of the growing interest in telephone bulletin boards, data services, and that sort of thing. Well, these can just as well be organized over the air. Instead of having a W1AW sending hours and hours of voice and CW messages every day, a radio bulletin board (RBB) station could sit, listening to a channel, for any inquiries. A request would bring on the sending in ASCII of a message which would be a menu of what is available from the RBB station.

The inquiring station would then select some part of the menu and ask for that information...which would be sent by the RBB station. What sort of information would be appropriate? Well, how about the latest in DX news, listing calls, QSL managers, times and frequencies, dates of expected operation? New countries then could be found easily. Or, how about Westlink news? Or other news reports? Then we could have the latest in FCC news, with release, proposed rule changes, dockets, and the dates for comment, perhaps even some ideas on the dockets to help amateurs explore all aspects of the proposed rule changes.

There are many information broadcasts which would be of value to amateurs, once we get to thinking about them. We could have a repeater update, hamfest information, a net directory listing all active low-band nets, their frequencies, times, and special interest. Traffic nets could be listed. Satellite information. The more you think about it, the more information comes to mind which would be of interest.

Using the old 300-baud standard, which to me is about like forcing everyone to send Morse code at two words per minute, we could send about 230 words per minute. This, as I mentioned recently, is the reading speed of a very slow reader. This makes as much sense as two words-per-minute CW. I think we'll have to start out with that, but I would suggest an immediate push for 1,200 baud as quickly as possible. That brings us up to about 1,000 words per minute, which is a lot better...but nowhere near what we really want.

Since 9,600 baud is being used with success over ordinary telephone lines, I would recommend that we move in on that standard. That would give us around a 7,300 words-per-minute transfer of information. Now we're talking a second or two for each transmission and the ability of many stations to access the RBB station in a short time.

HOW IT MIGHT WORK

Let's imagine our bulletin-board station set up on a synthesized channel. Let's further ask it to identify occasionally and send out regular pulses to hold the channel...perhaps one every second.

If I want to check on the latest DX news, I would type in "M?" on my built-in microcomputer system. Then, the next time the RBB polled the channel my rig would respond with that request for the menu. The RBB would immediately send a "bullipp" which would read out on my screen as the menu of information available. Number 7 might be my hot DX news, so I would type a "7" and a half-second

later, the RBB would poll my rig and trigger it to send the "7". The RBB would then dump the DX news, which might sound like a "beedlerupp" and I could then read out the hot scoop from my screen.

Obviously, we're going to have to experiment with error-correcting codes which will tell the other station how many bits of information are going to be exchanged. If the right number does not get through, the message can be repeated...or the missing part of it repeated. We're talking milliseconds, but we still may have to cope with CW jamming and other aggravations.

TRAFFIC HANDLING

Once we have a communications system which will perk along dependably at 7300 words per minute, we obviously have made it possible for a way to handle traffic that will knock the sox off voice or CW message handling. Not only can our messages go through without error in a second or two, but we also can address them for automatic relaying on any band. Relaying stations can be set up to poll a channel for traffic going to that area, perhaps pulsing every minute or so with a quick identifier. A hundred relay stations could all use the same channel without interference.

And once we are set up for that, imagine the value of this system for emergencies. A small pocket computer plugged into our mobile rig would enable us to join such an emergency net and have our traffic sent and received...or relayed...all automatically. Voice may be a little easier to use, but the speedy, error-proof digital system would win out. Of course, they are working hard on voice-to-digital encoding systems. They may eventually get one which works well. Going from digital to voice is a lot simpler...that's even built into my pocket Talking Clock now. And I saw talking wristwatches at the Consumer show in Chicago. They were junky, but a hint of what is coming.

EXPERIMENTING

I assume that we will have the usual number of hams who will do everything in their power to try to fight progress, complete with jamming experimental message-handling stations. Well, you may be able to drive a few pioneers up the wall, but you really are not going to be able to stop the marriage of computers and amateur radio. If you can't help us to grow and invent new communications techniques, at least don't make it so difficult for those of us who are really trying.

I came into amateur radio not very long after the last spark transmitter had been outlawed. If you read your old magazines, you'll find that there were a bunch of old-timers hanging in there, chanting "spark forever" right up to the minute it was illegal for them to use those rigs. They fought progress as hard as they could. We had a similar situation with sideband, with old-timer AMers hanging in there, bitching and moaning and making a mess out of the bands.

Will CW finally blow away as the cost of microcomputers keeps coming down and a computerized communications system is not much more expensive than a CW rig with a keyer? Well, who needs five words per minute when the same rig can shoot out 7300? For what? For emergencies? Hell's bells, if there ever is a time when we need automated fast communications, it is during an emergency. We need to be able to hook mobile, hand-held rigs, low bands, satellites, repeaters...everything together automatically. If we have the system going on an everyday basis, we'll have it there when we need it.

With satellites tied in, we will be able to reach any amateur in the world via autocall through our traffic-handling nets. We'll have instant access to enormous amounts of information through RBB stations. And the best part of it is that we really have very little to invent. We already have most of the basics that we need, with experimentation required to find out the best way to get it all to work...and then time to get enough amateurs involved to make the system work.

WHAT'S WAYNE DOING?

This is more of a letter to the several thousand personal friends who read *73* every month. Hello, Shep....

80 Microcomputing, which I started last year, is doing exceptionally well, running about 300 pages and more per month. I've also started a monthly dump of the programs from this magazine on cassettes called Load 80...another winner. Then there is the *Encyclopedia 80*, a monthly book of material on the TRS-80...things not published anywhere else...and a cassette dump of the programs for this called Encyclopedia Loader. That brings the monthly publications to eight, if we include *Desktop Computing*.

There are six more publications in prospect, including one for satellite TV, one for women's health, an Apple magazine... and so on. *Deskop Computing* will be out this month, the first computer magazine written totally in plain language.

As if that isn't enough to keep track of, we are working toward starting a technical institute to teach microcomputers, electronics, and publishing. I'm hoping that something can be done to get our government to help students from Third World countries to come and get an associate degree in electronics so that they will be able to go back home and help the growth of communications...and education.

Russia and Cuba are still going strong helping emerging nations with education, but their education has that political flavor we really don't need today. I wish that the US would recognize the importance of helping smaller countries develop and not ignore them until it is too late.

The Instant Software division is in a fast-growth mode. It takes up most of the Elm Street building and has the largest microcomputer lab in the world. Over 10,000 programs have been sorted through and evaluated, with about 1,000 being okayed for mass publication. Most of these are for the TRS-80, but we're making a major effort to get these converted for use on the Apple and Atari. We're also working to get programs written or converted for the Casio computers...the 702P and their new 9000.

My recent visits to the major microcomputer firms have been encouraging. A year ago, none of them really appreciated the importance of software to the sale of their product...now only Radio Shack seems to still have its corporate head in the software sand. This could be the breakthrough that Apple needs to get ahead of Tandy. Of course, this means more and more business for Instant Software.

Our Irish plant is now running, supplying software for Europe and Africa. I was in Africa for three weeks in August. There was a microcomputer exposition in Johannesburg, and I spoke there on world microcomputer industry trends, software developments, and so on. I also had an opportunity to address the Apple dealers and bring them up to date on the world Apple situation.

Outside of that...and being the president of the Peterborough Chamber of Commerce this year, I'm loafing around. As Dorothy Parker once wrote, burning your candle at both ends makes such a pretty flame.

HAM HELP

I'm looking for ham call license plates for my collection. I would like to swap for or buy plates from other states and provinces.

Bryan Hastings KA1HY
64 Concord Street
Peterborough NH 03458
(603)-924-6902

Does anyone know of any CW nets that a greenhorn might be able to check into to improve his CW operating proficiency? I'm not permitted to handle third-party traffic and even in the Novice band I get clobbered by QRM. Any suggestions would be appreciated. Many thanks.

Ciano R.E. Strachan C6ANI
PO Box N4106
Nassau NP Bahamas

I am looking for information on the HW-12-22-32 triband conversion made by Dynalab.

Jim Fyles WB8CZI
820 El Paso Blvd.
Denver CO 80221
(303)-428-6860

OSCAR ORBITS

Courtesy of AMSAT

TUNING IN TO OSCAR 8

OSCAR 8 is the only amateur satellite available for everyday communications. Using the satellite for two-way contacts requires a 2-meter signal of about 100 W ERP. This can be achieved either by using a linear amplifier or by erecting a high-gain antenna which is movable in both azimuth and elevation. Such complexities are unnecessary, however, if you simply want to listen to OSCAR 8. In fact, listening to OSCAR 8's 10-meter downlink is a fairly simple procedure and an excellent introduction to the fun of satellite communications. The satellite operates in Mode A (10-meter downlink) on Monday, Tuesday, Thursday, and Friday. The only equipment required is a receiver capable of tuning the high end of the 10-meter band and an omnidirectional antenna or dipole for 10 meters. You will also need some idea of when the satellite is in range. The simple method outlined below will help you determine when to listen for OSCAR 8, and it requires nothing more than a pencil, paper, and a pocket calculator. The method works satisfactorily for all locations in the northern hemisphere.

WHEN AND WHERE

The first step in using the data in the chart of orbital information on this page is to divide a sheet of paper into three columns labeled "Orbit No.," "Time," and "Crossing." Select a day that OSCAR 8 is scheduled to be in Mode A, and write the corresponding orbit number from the chart in your first column. Then get the time and equatorial crossing longitude from the same row of the chart and write them in the second and third columns. You should now have one row of data on your paper, the same data found in the chart for the date you have selected. At this point, you are ready to calculate the equatorial crossing time and longitude for each orbit of the selected day. A pocket calculator will be helpful for this, but even so, the process will be time consuming. We all must make sacrifices in the name of progress!

Now, add 1 to the orbit number and write the result just below the first orbit number. Add 103 minutes (1 hour, 43 minutes) to the original time in row one and write the result in column two of the second row. Finally, add 26 degrees to the longitude in row one and write the result in column three of row two. You should now have two complete rows of data in the homemade table you are constructing. Repeat this procedure, adding 1, 103, and 26 to the most recent numbers in columns one, two, and three until the total in column two exceeds 2400 hours, indicating that you have reached the end of one day's calculations. Whenever the total in column three exceeds 360, simply subtract 360 from the number before writing it into the table. There should be 14 or 15 rows of data in your completed table.

What you have just done is to develop a table showing the orbit number, crossing time, and equatorial crossing longitude for each orbit in the selected day. In essence, you have filled in the gaps in the charts printed in the magazine, which show data for only the first orbit of the day. A new table must be created for each day you plan to listen for OSCAR 8.

We are almost ready to choose a time for listening to OSCAR 8, but you must first determine your longitude. This is easily done by consulting a road map, most of which show longitude and latitude around the perimeter. Now examine your homemade table. Scan the third column, looking for crossing longitudes which are between approximately 10 degrees west of your longitude and 35 degrees east of your longitude. You should find two or three suitable longitudes in your table. When you find them, go across to column two and circle the times corresponding to these longitudes. On the day in question, those are the best times to start listening for OSCAR 8. If you live near the equator, you will begin to hear the satellite a few minutes before the calculated time, while more northerly listeners will hear it after the calculated time.

This is a relatively crude calculation, but it should allow you to hear OSCAR 8 reliably. It is important to remember that the satellite operates on Universal Time (UTC). Thus, when we speak of Monday being a Mode A day, we are referring to Monday UTC, not Monday local time.

WHAT YOU'LL HEAR

The OSCAR 8 10-meter downlink spans the frequency range from 29.400 to 29.500 MHz. A Morse telemetry beacon on 29.400 MHz transmits continuously at 20 wpm, sending coded information about the condition of the satellite. The telemetry consists of several groups of three digits each. Listening for the telemetry beacon is a good way to be sure you are hearing OSCAR 8 and not some other amateur activity on the same frequency.

When the satellite is in range, you will hear many QSOs in progress simultaneously in the 100 kHz that comprises the communications passband. Although satellite users tend to stick to a band plan which calls for CW at one end of the passband and SSB at the other, there is considerable mixing of the modes. OSCAR contacts tend to be short, since the satellite is in range for a maximum of only 20 minutes.

If you have 435-MHz receiving capability, try listening to OSCAR 8's Mode J transponder. Its downlink is 435.100 to 435.200 MHz. Mode J is activated on Saturday, Sunday, Tuesday, and Friday (note that OSCAR 8 is in Modes A and J simultaneously on Tuesday and Friday). The Mode J telemetry beacon can be found at 435.090 MHz.

You may have noticed that Wednesday is not mentioned as either a Mode A or Mode J day. This is because Wednesday is set aside for special experiments and the satellite is not available for normal communications use, although you are welcome to listen to the day's activities.

When listening to OSCAR, you will notice that the frequency of the transmissions from the satellite is constantly changing. This is the famous Doppler shift, caused by the high relative velocity between you and the satellite (thousands of miles per hour!). You will need one hand on the tuning knob almost continuously during an OSCAR 8 pass.

OSCAR represents an exciting opportunity to learn and perfect a new communications technique, and listening will get you started. For more information about amateur satellites, write to the Amateur Satellite Corporation (AMSAT), PO Box 27, Washington DC 20044.—WB8BTH.

ORBITAL INFORMATION

OSCAR 8 ORBITAL INFORMATION FOR OCTOBER

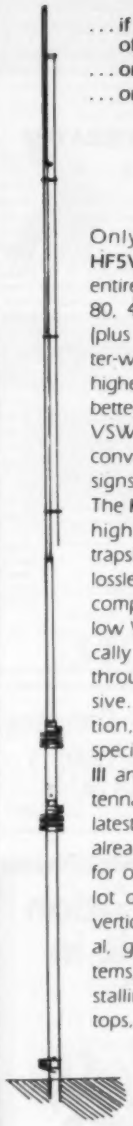
ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10212	1	0051:34	75.3
10226	2	0055:25	76.2
10240	3	0059:16	77.2
10254	4	0103:07	78.2
10268	5	0106:57	79.1
10282	6	0110:48	80.1
10296	7	0114:39	81.0
10310	8	0118:30	82.0
10324	9	0122:21	83.0
10338	10	0126:12	83.9
10352	11	0130:03	84.9
10366	12	0133:54	85.9
10380	13	0137:45	86.8
10394	14	0141:36	87.8
10407	15	0002:19	63.0
10421	16	0006:10	63.9
10435	17	0010:01	64.9
10449	18	0013:52	65.8
10463	19	0017:43	66.8
10477	20	0021:34	67.8
10491	21	0025:25	68.7
10505	22	0029:15	69.7
10519	23	0033:06	70.7
10533	24	0036:57	71.6
10547	25	0040:48	72.6
10561	26	0044:39	73.5
10575	27	0048:30	74.5
10589	28	0052:21	75.5
10603	29	0056:12	76.4
10617	30	0100:03	77.4
10631	31	0103:54	78.4

OSCAR 8 ORBITAL INFORMATION FOR NOVEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10645	1	0107:45	79.3
10659	2	0111:36	80.3
10673	3	0115:27	81.2
10687	4	0119:18	82.2
10701	5	0123:09	83.2
10715	6	0127:00	84.1
10729	7	0130:51	85.1
10743	8	0134:41	86.1
10757	9	0138:32	87.0
10771	10	0142:23	88.0
10784	11	0003:06	63.2
10798	12	0006:57	64.1
10812	13	0010:48	65.1
10826	14	0014:39	66.0
10840	15	0018:30	67.0
10854	16	0022:21	68.0
10868	17	0026:12	68.9
10882	18	0030:03	69.9
10896	19	0033:54	70.9
10910	20	0037:45	71.8
10924	21	0041:36	72.8
10938	22	0045:27	73.7
10952	23	0049:18	74.7
10966	24	0053:09	75.7
10980	25	0057:00	76.6
10994	26	0100:50	77.6
11008	27	0104:41	78.6
11022	28	0108:32	79.5
11036	29	0112:23	80.5
11050	30	0116:14	81.4

WHY PAY

FULL PRICE FOR AN 80-10 METER VERTICAL



. . . if you can use only 1/3 of it on 10?
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Only Butternut's new **HF5V-III** lets you use the entire 26-foot radiator on 80, 40, 20 and 10 meters (plus a full unloaded quarter-wavelength on 15) for higher radiation resistance, better efficiency and greater VSWR bandwidth than conventional multi-trap designs of comparable size. The **HF5V-III** uses only two high-Q L-C circuits (not traps!) and one practically lossless linear decoupler for completely automatic and low VSWR resonance (typically below 1.5:1) on 80 through 10 meters, inclusive. For further information, including complete specifications on the **HF5V-III** and other Butternut antenna products, ask for our latest free catalog. If you've already "gone vertical," ask for one anyway. There's a lot of information about vertical antennas in general, ground and radial systems, plus helpful tips on installing verticals on rooftops, on mobile homes, etc.

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HAM HELP

I would like to contact anyone concerning the construction of the "Heterodyne Deviation Meter" as published in the ARRL *Radio Amateur's Handbook* and in the *FM and Repeaters Handbook*. In particular, I need to know the type of crystal used.

Dave Harper W4NIQ
Route 2, Lincove
Fayetteville TN 37334

I am looking for a schematic or manual on several pieces of equipment: (1) Sylvania Electric TV marker generator, type 501; (2) Weston model 779 Analyzer VOM; (3) Hallicrafters model S38C; (4) RCA Voltohmyst #195A. I will be glad to pay for any copying costs.

Lorin McNutt KA9BZP
5460 West 1200 South
Fairmount IN 46928

I need information on a crystal filter marked as follows: Filtech Corp. Crystal Filter C.F. 7.825 MHz—model 2131 P/N 780055. I believe this unit was made for Hy-Gain equipment and will greatly appreciate any data on: (a) no. of poles; (b) bandwidth @-6dB and @-60dB; (c) impedance in and out; (d) insertion loss in dB; (e) present address of Filtech Corp. Thank you.

C.A. Carhoun, WB1ACU
11A Harold Street
Harwich Port MA 02646

I am looking for a source of technical information on the VHF/UHF Radio Telephone Service, i.e., IMTS, MTS, etc. Any information will be appreciated

G.S. Wienand WD4DLY
312 Madison Ave.
Cape Canaveral FL 32920

I need a manual and schematic for the following: Hammarlund HQ-170 receiver, Heath MM-1 multimeter, United Electronics Laboratory (UEL) model F 5-inch oscilloscope (schematic only for the scope).

William N. Richmond WD4CPQ
122 E. Adair St.
Louisville KY 40214

I am in need of a schematic diagram for a Heathkit Twoer, model HW-30. I will be glad to pay any reasonable duplicating and mailing costs, or I will duplicate on receipt and send back by mail.

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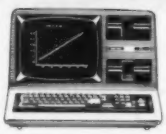

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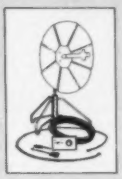

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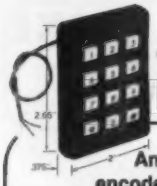

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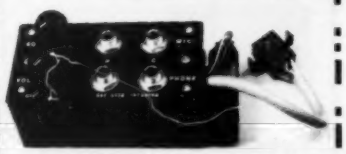

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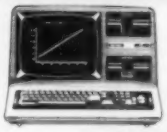

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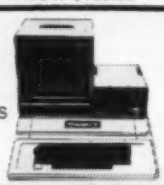

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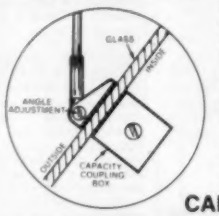

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"DOWN CONVERTERS"

1900 to 2500 MHZ Microwave Downconverters

In Regards to your request for information concerning our microwave receiver. This receiver is tunable over a range of 1900 to 2500 MHZ approximately,and is intended for amateur use. The local oscillator is voltage controlled (i.e.) making the I.F. range approximately 54 to 88 MHZ For Your Standard TV Set Channels 2 thru 7.

P.C.Board with Data

1 to 5	$15.00	6 to 11	$13.00	12 to 26	$11.00	27	up	$9.00

P.C.Board with all chip caps solder on. $30.00

P.C.Board with all parts for assembly. $49.99

P.C.Board with all parts for assembly plus 2N6603 $69.99

P.C.Board assembled and Tested. $69.99

P.C.Board assembled and Tested with 2N6603. $79.99

HMR II Downconverter with power supply , antenna (Dish) and all Cable for Instalation.180 Day Warranty .

1 to 5	$150.00	6 to 11	$140.00	12 to up	$125.00

Yagi Downconverter with Power Supply , Antenna (Yagi) and all cables for Instalation. 90 Day Warranty.

1 to 5	$150.00	6 to 11	$140.00	12	up	$125.00

Yagi Downconverter as above but Kit. (NO CABLES) With Box.

1 to 5	$125.00	6 to 11	$115.00	12	up	$100.00

HMR II Downconverter as above but Kit. (NO CABLES) With PVC.

1 to 5	$125.00	6 to 11	$115.00	12	up	$100.00

Special New Stock Of Carbide Drill Bits.

1.25mm	20	40	53	63
1.45mm	24	44	54	64
3.2mm	26	45	55	65
3.3mm	29	46	56	67
1/8	30	47	57	68
3/16	31	48	58	69
5/32	36	49	59	
7/32	37	50	60	Your Choice $1.99
13/64	38	51	61	
19	39	52	62	

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

"FILTERS"

Collins Mechanical Filter #526-9724-010 Model F455Z32F
455KHz at 3.2KHz Wide. $15.00

Atlas Crystal Filters

5.52-2.7/8	5.52MHz/2.7KHz wide 8 pole	
5.595-2.7/8/U	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.595-.500/4/CW	5.595MHz/.500KHz wide 4 pole CW	
5.595-2.7/LSB	5.595MHz/2.7KHz wide 8 pole lower sideband	
5.595-2.7/USB	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.645-2.7/8	5.645MHz/2.7KHz wide 8 pole	Your Choice
9.0SB/CW	9.0MHz/ 8 pole sideband and CW	$12.99

Kokusai Electric Co. Mechanical Filter #MF-455-ZL-21H
455KHz at Center Frequency of 453.5Kc Carrier Frequency of 455Kc 2.36Kc Bandwidth
$15.00

Crystal Filters

Nikko	FX-07800C	7.8MHz	10.00
TEW	FEC-103-2	10.6935	10.00
Tyco/CD	001019880	10.7MHz 2 pole 15KHz Bw. Motorola #48D84396K01 Thru #48D84396K05	4.00
Motorola	4884863B01	11.7MHz 2 pole 15KHz Bandwidth	5.00
PTI	5350C	12MHz 2 pole 15KHz Bandwidth	5.00
PTI	5426C	21.4MHz 2 pole 15KHz Bandwidth	5.00
CD	A10300	45MHz 2 pole 15KHz Bandwidth (For Motorola Communications equipment)	5.00

Ceramic Filters

Murata	BFB455B	455KHz	$ 2.40
	CFM455E	455KHz +- 5.5KHz	6.65
	CFM455D	455KHz +- 7KHz	6.65
	CFR455E	455KHz +- 5.5KHz	8.00
	CFU455E	455KHz +- 1.5KHz	2.90
	CFU455G	455KHz +- 1KHz	2.90
	CFW455D	455KHz +- 1KHz	2.90
	CFW455H	455KHz +- 3KHz	4.35
	SFB455D	455KHz	2.40
	SFE10.7	10.7MHz	2.67
	SFG10.7MA	10.7MHz	10.00
Clevite	TO-01A	455KHz	5.00
	TO-02A	455KHz	5.00
Nippon	LF-B4/CFU455I	455KHz +- 1KHz	5.80
	LF-B6/CFU455H	455KHz +- 1KHz	5.80
	LF-C18	455KHz	10.00
Tokin	CF455A/BFU455K	455KHz +- 2KHz	4.80
Matsushira	EFC-L455K	455KHz	7.00

ROTRON MUFFIN FANS Model Mark 4/MU2A1
These fans are new factory boxed 115vac at 14watts 50/60cps. Impedance Protected-F
CFM is 88 at 50cps and 105 at 60cps. $ 7.99

SPECTRA PHYSICS INC. Model 088 HeNe Laser Tubes.
Power output 1.6mw. Beam Dia. .75mm. Beam Dir. 2.7mr. 8Kv starting voltage
68K ohm 1watt ballast 1000vdc +-100vdc 3.7ma. TUBES ARE NEW $59.99

"AMPLIFIERS"

AVANTEK LOW NOISE AMPLIFIERS

Models	UTC2-102M	AP-20-T	AL-45-0-1	AK-1000M
Frequency Range	30 to 200MC	200 to 400MC	450 to 800MC	500 to 1000MC
Noise Figure	1.5dB	6.5dB	7dB	2.5dB
Voltage	+15vdc	+24vdc	-6vdc @ +12vdc	+12vdc @ -12vdc
Gain	29dB	30dB	30dB	25dB
Power Output	1dB Gain +7dBm	1dB Gain +20dBm	1dB Gain -5dBm	1dB Gain +8dBm
Price	$49.99	$49.99	$49.99	$69.99

Mini Circuits Double Balanced Mixers

Model RAY-3
Very High Level (+23dBm LO) 70KHz to 200MHz LO,RF,DC to 200MHz IF
Conversion Loss,dB One Octave From Band Edge 6Typ./7.5Max. Total Range 6.5Typ./8Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 55Typ./45Min. Mid. Range (LO-RF/LO-IF) 40Typ./30Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 30Typ./25Min.
Price $24.99

Model TSM-3
Standard Level (+7dBm LO) .1MHz to 400MHz LO,RF,DC to 400MHz IF
Conversion Loss,dB One Octave From Band Edge 5.3Typ./7.5Max. Total Range 6.5Typ./8.5Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 60Typ./50Min. Mid. Range (LO-RF/LO-IF) 50Typ./35Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 35TYP./25Min.
Price $11.99

Hewlett Packard Linear Power Microwave RF Transistor HXTR5401/35831E

Collector Base Brakedown Voltage at Ic=100ua	35volts min.
Collector Emitter Brakedown Voltage at Ic=500ua	30volts min.
Collector Cutoff Current at Vcb=15v	100ua max.
Forward Current Transfer Ratio at Vce=15v,Ic=15ma	15min,40typ,125max
Transducer Power Gain at Vce=18v,Ice=60ma,F=2GHz.	3dBmin,4dBtyp
Maximum Available Gain at Vce=18v,Ic=60ma,F=1GHz/F=2GHz	14dB typ,8dB typ
Price $29.99	

Motorola RF Power Amplifier Modules

Model	MHW612A	MHW613A	MHW710	MHW720
Frequency Range	146 to 147MHz	150 to 174MHz	400 to 512MHz	400 to 470MHz
Voltage	12.5vdc	12.5vdc	12.5vdc	12.5vdc
Output Power	20watts	30watts	13watts	20watts
Minimum Gain	20dB	20dB	19.4dB	21dB
Harmonics	-30dB	-30dB	40dB	40dB
RF Input Power	400mw	500mw	250mw	250mw
Price	$57.50	$59.80	$57.50	$69.00

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"TRANSISTORS"

WATKINS JOHNSON WJ-M62 3.7 to 4.2GHz Communication Band Double Balanced Mixer $100.00

SSB Conversion Loss	4.9dB Typ.	6dB Max.	fR 3.7 to 4.2GHz	
	5.5dB Typ.	6.5dB Max.	fI DC to 1125MHz	fL fR
			fI 880MHz	fL fR
SSB Noise Fiqure			fR 3.7 to 4.2GHz	
	4.9dB Typ.	6dB Max.	fI 30 to 1125MHz	fL fR
	5.5dB Typ.	6.5dB Max.	fI 880MHz	fL fR
Isolation				
fL at R	30dB Min.	40dB Typ.	fL 2.8 to 5.35GHz	
fL at I	25dB Min.	30dB Typ.	fL 4.5 to 5.35GHz	
	20dB Min.	30dB Typ.	fL 3.6 to 4.5GHz	
	15dB Min.	25dB Typ.	fL 2.8 to 3.6GHz	
Conversion Compression	1dB Max.		fR Level +2dBm	
Flatness	.2dB Peak to Peak Over any 40MHz Segment of fR=3.7 to 4.2GHz			
Third Order Input Intercept	+11dBm		fR1=4GHz fR2=4.01GHz Both at -5dBm fL=4.5GHz	
Group Time Delay	.5ns Typ.	.75ns Max.	fR3.7 to 4.2GHz fL 3480MHz	@ +13dBm
VSWR	L-Port	1.25:1 Typ.	2.0:1	fL 2.8 to 5.35GHz
	R-Port	1.25:1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
		1.4 :1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
	I-Port	1.5 :1 Typ.	2.0:1	fI=100MHz
		1.3 :1 Typ.	2.0:1	fI=500MHz
		1.8 :1 Typ.	2.5:1	fI=1125MHz

SGS/ATES RF Transistors			Motorola RF Transistor	
Type.	BFQ85	BFW92	MRF901	2N6603
Collector Base V	20v	25v	25v	25v
Collector Emitter V	15v	15v	15v	15v
Emitter Base V	3v	2.5v	3v	3v
Collector Current	40ma	25ma	30ma	30ma
Power Dissipation	200mw	190mw	375mw	400mw
HFE	40min. 200max.	20min. 150max.	30min. 200max.	30min. 200max.
FT	4GHZ min. 5GHz max.	1.6GHz Typ.	4.5GHz typ.	2GHz min.
Noise Fiqure	1GHz 3dB Max.	500MHz 4dB Typ.	1GHz 2dB Typ.	2GHz 2.9dB Typ.
Price	$1.50	$1.50	$2.00	$10.00

National Semiconductor Variable Voltage Regulator Sale !!!!!!!!!

LM317K	LM350K	LM723G/L	LM7805/06/08/12/15/18/24
1.2 to 37vdc	1.2 to 33vdc	2 to 37vdc	5, 6, 8,12,15,18,24vdc
1.5Amps	3Amps	150ma.	1Amp
TO-3	TO-3	TO-100/TO-116	TO-220/TO-3
$4.50	$5.75	$1.00 $1.25	$1.17 $2.00

P & B Solid State Relays Type ECT1DB72

5VDC Turn On 120VAC Contact 7Amps
20Amps on 10"x10"x.062" Alum.Heatsink with
Silicon Grease $5.00

*May Be Other Brand Equivalent

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"MIXERS"

WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz	
	8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above	
	8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz	dB 2.4 Typ.	MAG F=2GHz	dB 12 Typ.	$5.30
F=3GHz	dB 3.4 Typ.	F=3GHz	dB 9 Typ.	
F=4GHz	dB 4.3 Typ.	F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacutures and described in the Motorola RF Data Book.

10pf	22pf	30pf	40pf	100pf	250pf	1 to 10pcs. .60¢ each
13pf	25pf	32pf	43pf	120pf	820pf	11 to 50pcs. .50¢ each
14pf	27pf	33pf	62pf	180pf		51 to 100pcs. .40¢ each
20pf	27.5pf	34pf	80pf	200pf		

NIPPON ELECTRIC COMPANY TUNNEL DIODES

		MODEL 1S2199	1S2200 $7.50
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ration (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

List all Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

PRICE $7.50

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$ POR	SK626	Chimney	$ 7.70
SK406	Chimney	35.00	SK630	Socket	45.00
SK416	Chimney	22.00	SK636B	Chimney	26.40
SK500	Socket	330.00	SK640	Socket	27.50
SK506	Chimney	47.00	SK646	Chimney	55.00
SK600	Socket	39.50	SK711A	Socket	192.50
SK602	Socket	56.00	SK740	Socket	66.00
SK606	Chimney	8.80	SK770	Socket	66.00
SK607	Socket	43.00	SK800A	Socket	150.00
SK610	Socket	44.00	SK806	Chimney	30.80
SK620	Socket	45.00	SK900	Socket	253.00
SK620A	Socket	50.50	SK906	Chimney	44.00

JOHNSON TUBE SOCKETS

124-115-2/SK620A	Socket	$ 30.00	124-113	Bypass Cap.	$ 10.00
124-116/SK630A	Socket	40.00	122-0275-001	Socket (For 4-250A,4-400A,3-400Z, 3-500Z)	10.00 2/$15.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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"TUBES"

TUBES	PRICE
2E26	$ 4.69
2K28	100.00
3B28	5.00
3-500Z	102.00
3-1000Z/8164	300.00
3CX1000A/8283	200.00
3X2500A3	200.00
4-65A/8165	45.00
4-125A/4D21	58.00
4-250A/5D22	68.00
4-400A/8438	71.00
4-400C/6775	80.00
4-1000A/8166	300.00
4CS250R	69.00
4X150A/7034	30.00
4X150D/7035	40.00
4X150G	50.00
4X250B	30.00
4CX250B/7203	45.00
4CX250F/7204	45.00
4CX250FG/8621	55.00
4CX250K/8245	100.00
4CX250R/7580W	69.00
4CX300A	99.00
4CX350A/8321	100.00
4CX350FJ/8904	100.00
4X500A	100.00
4CX600J	300.00
4CX1000A/8168	300.00
4CX1500B/8660	300.00
4CX3000A/8169	300.00
4CX5000A/8170	400.00
4CX10000D/8171	500.00
4CX15000A/8281	700.00
4E27/A/5-123A/B	40.00
4PR60A	100.00
4PR60B/8252	175.00
KT88	15.00
DX362	35.00
DX415	35.00
572B/T160L	44.00
811	10.00
811A	13.00
812A	15.00
813	38.00
4624	100.00
4665	350.00
5551A	100.00
5563A	77.00
5675	15.00

TUBES	PRICE
5721	$200.00
5768	85.00
5836	100.00
5837	100.00
5861/EC55	110.00
5876A	15.00
5881/6L6	5.00
5894/A	45.00
5894B	55.00
6080	10.00
6083/AX9909	89.00
6098/6AK6	14.00
6115/A	100.00
6146	6.00
6146A	6.50
6146B/8298A	7.50
6146W	14.00
6159	11.00
6161	70.00
6291	125.00
6293	20.00
6360	4.00
6524	53.00
6550	7.00
6562/6794A	25.00
6693	110.00
6816	58.00
6832	22.00
6883/8032A/8552	7.00
6884	46.00
6897	110.00
6900	35.00
6907	55.00
6939	15.00
7094	75.00
7117	17.00
7211	60.00
7289/3CX100A5	34.00
7360	11.00
7377	67.00
7486	75.00
7650	250.00
7843	58.00
7868	4.00
7984	12.00
8072	55.00
8121	50.00
8122	85.00
8236	30.00
8295/PL172	300.00

TUBES	PRICE
8462	$100.00
8505A	73.50
8533W	92.00
8560A	55.00
8560AS	57.00
8608	34.00
8624	67.20
8637	38.00
8647	123.00
8737/5894B	55.10
8807	1000.00
8873	260.00
8874	260.00
8875	260.00
8877	533.00
8908	12.00
8916	1500.00
8930/X651Z	45.00
8950	10.00
6BK4C	5.00
6DQ5	4.00
6FW5	5.00
6GE5	5.00
6GJ5	5.00
6HS5	5.00
6JB5/6HE5	5.00
6JB6A	5.00
6JM6	5.00
6JN6	5.00
6JS6B	5.00
6JT6A	5.00
6KD6	5.00
6K66/EL505	5.50
6KM6	5.00
6KN6	5.00
6LF6	6.00
6LQ6	6.00
6LU8	5.00
6LX6	5.00
6ME6	5.00
12JB6A	6.00

"WE ARE ALSO LOOKING FOR TUBES NEW/USED ECT."

WE BUY SELL OR TRADE

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"MICROWAVE COMPONENTS"

AIL	70A
AIL	7010
AIL	07050
AIL	07051
AIL	07091
ARRA	KU520A
ARRA	2416-20
ARRA	3614-60X
ARRA	4684-20C
ARRA	6684-20F
Alfred	1151
Alfred	1152
Alfred	1153
American	2000-6254
American	2020-6600
Boonton	41-4B
Coaxial Dynamics	3023
Coaxial Dynamics	3025
FXR/Microlab	CW-A21
FXR/Microlab	XP-A39
FXR/Microlab	S164A
FXR/Microlab	N414A
FXR/Microlab	601A07
FXR/Microlab	G601B
General Microwave	N402A-3
General Microwave	N710-20
General Microwave	4276-2
Hewlett Packard	G281A
Hewlett Packard	H281A
Hewlett Packard	X281A
Hewlett Packard	MX292B
Hewlett Packard	WX292A
Hewlett Packard	345B
Hewlett Packard	G347A
Hewlett Packard	H347A
Hewlett Packard	S347A
Hewlett Packard	X347A
Hewlett Packard	349A
Hewlett Packard	355C
Hewlett Packard	360D
Hewlett Packard	G382A
Hewlett Packard	J382A
Hewlett Packard	P382A
Hewlett Packard	X382A
Hewlett Packard	411A-21D
Hewlett Packard	H421A
Hewlett Packard	H421A
Hewlett Packard	H424A
Hewlett Packard	477B
Hewlett Packard	G485A
Hewlwtt Packard	J485B
Hewlett Packard	J486A
Hewlett Packard	H487B
Hewlett Packard	K487C
Hewlett Packard	P487B
Hewlett Packard	X487A
Hewlett Packard	X487B
Hewlett Packard	G532A
Hewlett Packard	H532A
Hewlett Packard	J532A
Hewlett Packard	M532A
Hewlett Packard	P532A
Hewlett Packard	X532A
Hewlett Packard	536A
Hewlett Packard	G752D
Hewlett Packard	X752A
Hewlett Packard	X752C
Hewlett Packard	X752D
Hewlett Packard	766D
Hewlett Packard	767D
Hewlett Packard	787D
Hewlett Packard	G910B
Hewlett Packard	X914B
Hewlett Packard	2830A
Hewlett Packard	3503
Hewlett Packard	8431A
Hewlett Packard	8436A
Hewlett Packard	8471A
Hewlett Packard	8472A
Hewlett Packard	8732A
Hewlett Packard	8733A
Hewlett Packard	10100B
Hewlett Packard	10855A
Hewlett Packard	11660A
Hewlett Packard	11693A
Hewlett Packard	13510
Hewlett Packard	33001C
Hewlett Packard	33102A
Hewlett Packard	C79-33602A
Hewlett Packard	39098A
Kay	30-0/432D
Kay	NM781
Kay	7921A
Kay	7921A1
Lectronic	503A
MDL	90LW26-1
MECA	715-152
Merrimac	AU-26A/
Microtech	214972
Military	AT-68/UPM
Military	UG-528/U
Narda	708
Narda	792FM
Narda	2301-20
Narda	2301-30
Narda	2366
Narda	2863
Narda	2864
Narda	2979
Narda	3002-10
Narda	3002-20
Narda	3003-10
Narda	3003-30
Narda	3004-10

MICROWAVE COMPONENTS

Noise Source	$100.00
Noise Source .2 to 2.6GHz	100.00
Noise Source	100.00
Noise Source 7.05 to 10GHz	150.00
Noise Source 12.4 to 18GHz	200.00
Variable Attenuator	100.00
Variable Attenuator 0-20dB .5 to 1GHz 1Ow	50.00
Variable Attenuator 0-60dB 1 to 2GHz 10w	50.00
Variable Attenuator 0-20dB 3 to 4GHz 10w	75.00
Variable Attenuator 0-20dB 7 to 11GHz	75.00
Sampler Attenuator 1 to 2GHz 0 to 50dB	200.00
Sampler Attenuator 2 to 4GHz 0 to 50dB	200.00
Sampler Attenuator 4 to 8GHz 0 to 50dB	200.00
Adapter X to WR 8.2 to 12.4GHz	75.00
Directional Coupler .5 to 1GHz 6dB	75.00
Power Detector	75.00
Directional Power Detector 60wfwd/15wrev/225-400mc	50.00
Directional Power Detector 60wfwd/15wrev/116-150mc	50.00
Coupler	35.00
Crystal Detector	35.00
Variable Attenuator 0-50dB 2.6 to 3.95GHz	450.00
Frequency Meter 3.95 to 11GHz	450.00
Adapter	35.00
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Power Detector	100.00
Directional Coupler 2 to 4GHz 20dB	75.00
10D:1 Divider 1MC to 250MC	35.00
Adapter G to N 3.95 to 5.85Gc	50.00
Adapter H to N 7.05 to 10Gc	35.00
Adapter X to N 8.2 to 12.4Gc	35.00
Adapter 10 to 15Gc	75.00
Adapter 15 to 22Gc	75.00
Noise Source IF 30/60Mc	200.00
Noise Source 3.95 to 5.85Gc	250.00
Noise Source 7.05 to 10Gc	250.00
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Low Pass Filter 4100Mc	50.00
Variable Attenuator 0 to 50dB 3.95 to 5.85Gc	500.00
Variable Attenuator 0 to 50dB 5.85 to 8.2Gc	500.00
Variable Attenuator 0 to 50dB 12.4 to 18Gc	350.00
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Crystal Detector 7.05 to 10Gc	50.00
Crystal Detector 7.05 to 10Gc Matched Pair	200.00
Crystal Detectot 7.05 to 10Gc Matched Pair	400.00
Thermistor Mount For 430 Series 10Mc to 10Gc	75.00
Barretter Mount 9.5% to 5.85Gc	85.00
Detector Mount 5.85 to 8.2Gc	85.00
Thermistor Mount 5.85 to 8.2Gc	180.00
Thermistor Mount 7.05 to 10Gc	50.00
Thermistor Mount 18 to 26Gc	135.00
Thermistor Mount 12.4 to 18Gc	155.00
Thermistor Mount 8.2 to 12.4Gc	65.00
Thermistor Mount 8.2 to 12.4Gc	85.00
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Frequency Meter 7.05 to 10Gc	500.00
Frequency Meter 5.3 to 8.2Gc	400.00
Frequency Meter 10 to 15Gc	500.00
Frequency Meter 12.4 to 18Gc	400.00
Frequency Meter 8.2 to 12.4Gc	350.00
Frequency Meter .94 to 4.2Gc	600.00
Directional Coupler 20dB 3.95 to 5.85Gc	200.00
Directional Coupler 3dB 8.2 to 12.4Gc	200.00
Directional Coupler 10dB 8.2 to 12.4Gc	200.00
Directional Coupler 20dB 8.2 to 12.4Gc	200.00
Dual Directional Coupler .94 to 1.975Gc 20dB	50.00
Dual Directional Coupler 1.9 to 4Gc 20dB	50.00
Directional Detector 1.9 to 4.1Gc	200.00
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Variable Attenuator 2 to 2.5Gc 0 to 17dB min. 2.5 to 12.4Gc 0 to 20dB min.	250.00
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Variable Directional Coupler 1.2 to 1.4Gc 7 to 12dB	90.00
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Directional Coupler .95 to 2Gc 20dB	100.00
Directional Coupler 2 to 4Gc 10dB	100.00
Directional Coupler 2 to 4Gc 30dB	100.00
Directional Coupler 4 to 10Gc 10dB	100.00

"TEST EQUIPMENT"

TEST EQUIPMENT

Boonton	202J	AM FM Signal Generator 195 to 270Mhz	450.00
Boonton	202J/207H	AM FM Signal Generator and Univerter 100Khz to 55Mc and 195 to 270Mc	600.00
CMC	931	Heterodyne Converter 200 to 1200Mc	200.00
Chushman	MON5	Monitor	750.00
Alfred	8000/7051	Sweep Network Analyzer 100Khz to 40Gc	800.00
Meguro	MSG-2282A	Standard Signal Generator For CB	250.00
Gertsch	FM3	Frequency Meter 20 to 1000Mc	150.00
Systron Donner	1037/1291A	Frequency Meter 0 to 50Mc with Plug In to 500Mc	500.00
Singer	SPA3/25A	Spectrum Analyzer 1Kc to 25Mc and a G-G Companion Sweep Generator 0 to 15Mc and PS-19 Power Supply	1500.00
Measurements	65B	Standard Signal Generator 75Hz to 35Mc	250.00
Measurements	14D	Standard Deviation Meter 25 to 1000Mc	200.00
Polarad	MSG-2	Signal Generator 2150 to 4600Mc	500.00
E.M.	574	Microwave Swept Oscillator 8 to 12.4Gc	750.00
Monsanto	1107	Time Interval Plug In	50.00
Military	TS-1011/	UPM84 Spectrum Analyzer 10Mc to 40Gc with 1Each Filter F335/F336/F337/F338/F341/1Each Attenuator CN411/CN410/CN409 and 1Each Adapter UG1239/UG1240/UG1241/UG1242	1800.00
General Radio	805C	Standard Signal Generator 16Kc to 50Mc	300.00
Hewlett Packard	230A	Power Amplifier 10 to 500Mc 4.5watts	400.00
Hewlett Packard	230B	Power Amplifier 10 to 500Mc 4.5watts	800.00
Hewlett Packard	240A	Sweep Generator 4.5 to 120Mc	400.00
Hewlett Packard	410C	VTVM to 700Mhz	400.00
Hewlett Packard	415D	SWR Meter	250.00
Hewlett Packard	431B	Power Meter 10Mc to 40Gc	150.00
Hewlett Packard	606A	Signal Generator 50Khz to 65Mc	800.00
Hewlett Packard	608D	Signal Generator 10 to 420Mc	400.00
Hewlett Packard	608C	Signal Generator 10 to 480Mc	500.00
Hewlett Packard	608E	Signal Generator 10 to 450Mc	1500.00
Hewlett Packard	608F	Signal Generator 10 to 455Mc	1500.00
Hewlett Packard	612A	Signal Generator 450 to 1230Mc	500.00
Hewlett Packard	614A	Signal Generator 900 to 2100Mc	500.00
Hewlett Packard	616A	Signal Generator 1.8 to 4.2Gc	400.00
Hewlett Packard	616B	Signal Generator 1.8 to 4.2Gc	500.00
Hewlett Packard	618A	Signal Generator 3.8 to 7.6Gc	400.00
Hewlett Packard	618B	Signal Generator 3.8 to 7.6Gc	500.00
Hewlett Packard	620A	Signal Generator 7 to 11Gc	400.00
Hewlett Packard	623B	Test Set 5925 to 7750Mc	500.00
Hewlett Packard	626A	Signal Generator 10 to 15Gc	2000.00
Hewlett Packard	628A	Signal Generator 15 to 21Gc	2500.00
Hewlett Packard	940A	Frequency Doubler 26.5 to 40Gc	1000.00
Hewlett Packard	3550A	Portable Test Set	1000.00
Hewlett Packard	5245L	Frequency Counter 0 to 50Mc	1000.00
Hewlett Packard	5251A	Plug In For above 20 to 100Mc	100.00
Hewlett Packard	5252A	Plug In For above 100 to 350Mc	200.00
Hewlett Packard	5253B	Plug In For above 50 to 500Mc	350.00
Hewlett Packard	5254B	Plug In For above 200Mc to 3Gc	750.00
Hewlett Packard	5260A	Frequency Divider to 12.4Gc For above	1000.00
Hewlett Packard	5262A	Plug In For above Time Interval	100.00
Hewlett Packard	5327B	DVM and Frequency Meter to 550Mc	1500.00
Hewlett Packard	DY5636	H Band Generator/Test Set 7.1 to 8.5Gc	1000.00
Tektronix	491	Spectrum Analyzer Solid State 10Mc to 40Gc.	7000.00
Micro Tel	MSR903	Microwave Receiver to 40Gc Digital Readout	9000.00
Tektronix	190B	Signal Generator 350Khz to 50Mc	150.00
Telonic	2003	Sweep/Signal Generator Systems 3305 5 to 1500Mc Autoplex,2/3323 1 to 2000Mc Variable Marker,3340 RF/Output Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370Display Prcoessing.	1000.00
Telonic	2003	Sweep/Signal Generator Systems 3303 5 to 500Mc Sweep,3323 1 to 2000Mc Variable Marker,3343 RF/Output 50 ohms,3340 RF Output/Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370 Display Processing.	750.00

MICROWAVE COMPONENTS

Narda	3004-20	Directional Coupler 4 to 10Gc 20dB	100.00
Narda	3032	Hybrid .95 to 2Gc 3dB	150.00
Narda	3033	Hybrid 2 to 4Gc 3dB	150.00
Narda	3039-20	Directional Coupler 125 to 250Mc 20dB	150.00
Narda	3040-20	Directional Coupler 240 to 500Mc 20dB	125.00
Narda	3043-20	Directional Coupler 2 to 4Gc 20dB	100.00
Narda	3044-20	Directional Coupler 4 to 8Gc 20dB	100.00
Narda	3044B20	Directional Coupler 3.7 to 8.3Gc 20dB	150.00
Narda	3045C30	Directional Coupler 7 to 12.4Gc 30dB	125.00
Narda	4035	Hybrid 3dB	150.00
Narda	22006/	3043-20 Directional Coupler 1.7 to 4Gc 20dB	100.00
Narda	22007/	3043-30 Directional Coupler 1.7 to 4Gc 30dB	100.00
Narda	22011/	3003-10 Directional Coupler 2 to 4Gc 10dB	100.00
Narda	22012/	3003-30 Directional Coupler 2 to 4Gc 30dB	100.00
Narda	22377	Adapter X to N 8.2 to 12.4Gc	35.00
Narda	22538/	4014-10 Directional Coupler 3.85 to 8Gc 10dB	75.00
Narda	22539/	4015C1D Directional Coupler 7.4 to 12Gc 10dB	85.00
Narda	22540A/	4013C10 Directional Coupler 2 to 4Gc 10dB	75.00
Narda	22574	Directional Coupler 2 to 4Gc 10dB	100.00
Narda	22689	Directional Coupler 15.8 to 17.3Gc	125.00
Narda	22876/	4014C6 Directional Coupler 3.85 to 8Gc 6dB	100.00
Narda	23105/	4015C3O Directional Coupler 7 to 12.4Gc 30dB	100.00
Norsal	14064-30	Directional Coupler 6 to 10Gc 30dB	75.00
PRD	C101	Variable Attenuator 5.85 to 8.2Gc 0 to 60dB	350.00
PRD	U101	Variable Attenuator 12.4 to 18Gc 0 to 60dB	300.00
PRD	205A	Slotted Line with Probe 4 to 10Gc	100.00
PRD	585A	Frequency Meter 8.2 to 10Gc	125.00
PRD	K3414	90° Twist 18 to 26.5Gc	50.00
PRD	5B15	Wavemeter 7 to 10.6Gc	75.00
PRD	N6001	Crystal Switch	50.00
PRD	X628A	Thermistor Mount 8.2 to 12.4Gc	125.00
Quantatron	S100	Roudstub Tuner	50.00
RLC	A-2610C	Variable Attenuator	50.00
Radar Design	D1536	Directional Coupler	75.00
Sage	752-3	Coupler	25.00
Sage	2503	Mixer	25.00
Sage	7753-3	Directional Coupler 4 to 6Gc 3dB	50.00
Sperry Microline	1261	Frequency Meter 5.84 to 8.2Gc	200.00
Stoddart	90515	10dB Attenuator	35.00
Systron Donner	DBE319A	Tunable Detector 1B to 26.5Gc	200.00
Tektronix	S1	Sampling Head	Call
Tektronix	S2	Sampling Head	Call
Tektronix	S50	Pulse Generator Head	Call
Tektronix	B170A	170 ohm Variable Attenuator	50.00
Telonic	TBP417-34-5CD2	Bandpass Filter	15.00
Texscan	SVF250-500-1AA	Tunable Bandpass Filter 250 to 500Mc	250.00
Transco	919C70100	SPDT Switch	25.00
Waveline	601	Adapter X to TNC 8.2 to 12.4Gc	35.00
Waveline	9009-10	Directional Coupler 4 to 10Gc 10dB	100.00
Wavetek	5070	0 to 70dB Variable Attenuator	75.00
Weinschel Eng.	2692	+30 to 60dB Vairable Attenuator	50.00

Microwave Equipment

Manufacture	Model	Description	Price
PRD	219/3302/ 3302L/1106A	20 to 1000Mhz Standing Wave Detector and Matched Load	$250.00
Hewlett Packard	805A	Slotted Line 500Mhz to 4Ghz	200.00
Hewlett Packard	805C	Slotted Line 500Mhz to 4Ghz	400.00
Hewlett Packard	809B with	8068 Slotted Line 3 to 12Ghz/G810B Slotted Line 3.95 to 5.85Ghz/J810B Slotted Line 5.85 to 8.2Ghz/X810B Slotted Line 8.2 to 12.4Ghz/P810B Slotted Line 12.4 to 18Ghz/ X281A & H281A Adapter/HX292B Tapered Transition/444A Probe 2.6 to 18Ghz/and a 447B Probe/H810B Slotted Line 7.05 to 10.5	900.00
Hewlett Packard	809B with	8068 Slotted Line 3 to 12Ghz/H810B Slotted Line 7.05 to 10.5Ghz/X810B Slotted Line 8.2 to 12.4Ghz/HX292B Tapered Transition H to X/H281A & X281A/with Probe.444	550.00

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74S0N	43	LM340T-18	85	CD4071	45	416	16.00		
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74S0N	43	LM350	5.50	CD4073	46	**CLOCKS**			
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74100N	1.35	LM379	5.00	CD4078	1.45	MM5312	2.95		
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74L53N	35	NE570N	4.75	74C173	1.75	8214	3.95		
74L51N	1.00	78L05	60	74C154	3.50	8216	2.90		
74L52N	35	78L08	60	74C160	2.75	8224	3.45		
74L27N	35	78M05	65	74C161	2.75	8228	4.95		
74L28N	35	75108	1.75	74C192	1.65	8251	6.95		
74L30N	30	75491CN	.50	74C221	1.60	8253	15.00		
74L53N	60	75492CN	.50	74C905	6.00	8255	5.75		
74L38N	50	75494CN	.89	74C906	75	8257	10.95		
74L574N	45			74C914	1.95	8259	10.95		
74L575N	65			74C922	5.00	8802CP	13.95		
74L580N		**A to D CONVERTER**		74C923	5.50	8802DP plas	11.95		
74L593N	75	80386	4.50	74C925	7.50	8T26	9.50		
74L595N	1.00	8700CJ	13.95	74C926	6.95	CDP1802CD	28.95		
74L597N	1.15	8701CJ	22.00	74C927	6.95	CDP1802D	15.00		
74L5122N	45	8750CJ	13.95			CDP1610P	7.95		
74L5139N	45	LD130	9.95	**INTERFACE**					
74L5132N	89	1406C/VFF	7.40	8095	65	**UART/FIFO**			
74L5136N	50	ICL7103	9.50	8096	65	AY5-1013	5.50		
74L5151N	75	ICL7107	14.25	8097	65	AY5-1014	7.50		
74L5155N	75			8098	65	3341	6.05		
74L5157N	1.10	**CMOS**		8212	1.03				
74L5162N	1.10	CD4000	25	8T10	4.50				
74L5163N	1.10	CD4001	35	8T13	3.00	**PRIOR**			
74L5174N	1.15	CD4002	35	8T20	3.10	1702A	4.50		
74L5190N	1.25	CD4006	1.10	8T23	3.10	2532	19.75		
74L5211N	1.25	CD4007	25	8T24	3.00	2708	9.95		
74L5258N	1.00	CD4008	1.20	8T25	3.20	2716T1	8.50		
74L5367N	89	CD4009	45	8T26	1.69	2716 5 Volt	9.95		
		CD4010	45	8T97	1.69	8-2716 5 Volt	48.00		
LINEAR		CD4011	35	8T97	1.69	2732	19.75		
CA3045	90	CD4012	28	8T98	1.69	2758	14.00		
CA3046	1.10	CD4013	47			8741A	55.00		
CA3081	1.60	CD4014	1.25	**MISC/MEMORY**		8748	55.00		
CA3082	1.50	CD4015	1.25	**RAM**		8749-8	59.00		
CA3089	3.40	CD4016	55	2101-1	2.95	8755	59.00		
LM301AN/AH	35	CD4017	1.05	2102-1	95	N82S23	4.95		
LM305H	.87	CD4018	.94	2102AL-4	1.45	N82S123	4.95		
LM307N	1.00	CD4020	1.02	2102AN-2L	1.65	N82S126	4.95		
LM309K	1.75	CD4021	1.35	2107B-4	3.75	N82S129	4.95		
LM311H/N	90	CD4022	1.10	2111	3.75	N82S131	4.95		
LM317T	1.65	CD4023	.28	2112-2	3.95	N82S135	6.75		
LM317K	3.75	CD4024	.75	2114	3.75	N82S137	6.75		
LM318	1.50	CD4025	.28	2114L 300ns	4.25	DM8577	7.90		
						8223	3.50		

CONNECTORS

36 pin edge	2.50
44 pin edge	2.75
50 pin edge	4.00
100 pin edge	4.50
100 pin edge W/W	5.75

IC SOCKETS

Solder Tin	Low Profile		
PIN	1 UP	PIN	1UP
8	.15	22	.28
14	.14	24	.30
16	.16	28	.42
18	.27	36	.58
20	.29	40	.57

2 level 14 pin ww .70

WIRE WRAP LEVEL 3

PIN			
8	.55	24	.93
16	.57	28	1.00
18	.57	40	1.59

CRYSTALS

1 MHz	4.50
2 MHz	4.50
4 MHz	4.25
4.43 MHz	4.25
10 MHz	4.25
18 MHz	3.90
20 MHz	3.90
32 MHz	3.90
32768 Hz	4.00
1.8432 MHz	4.50
3.5795 MHz	1.03
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4575 MHz	4.50
3.2768 MHz	4.50
3.9688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
6.5536 MHz	4.50
14.31818 MHz	4.75
18.432 MHz	4.50
22.1184 MHz	4.50

KEYBOARD ENCODERS

AY5-2376	$12.50
AY5-3600	17.95
AY5-9100	10.50
AY5-9200	16.50
74C922	5.50
74C923	6.00
HD0165-5	6.95
AY5-9400	10.50

D Connectors RS232

DB25P	3.62
DB25S	5.20
Cover	1.67
DE9S	1.95
MAN72/74	CA/CC 300 1.00
DL704	CC 300 1.25
DL707/DL707R	CA 300 1.00
DL727/728	CA/CC 300 1.90
DL747/748	CA/CC 600 1.95
FND338	CC 357 .70
FND500/507	CC/CA 500 1.35
FND503/510	CC/CA 300 .90
FND600/607	CC/CA 600 2.25
3 digit Bubble	.50
10 digit display	1.25
7529 Green photocell	.39
TIL311-Hex	9.50
MAN3640	CC 30 1.10
MAN4610	CA 40 1.20
MAN6640	CC 40 1.20
MAN4710	CA 40 .35
MAN4740	CC 40 1.20
MAN6640	CC 56 2.95
MAN6710	CA 60 1.35
MAN6740	CC 60 1.35

MA1002A, C, E	8.95
MA1012A	8.95
103P3 transformer	2.25
MA1012A Transformer	2.25

Tokwiden Terminal

Model 912	$785.00
Model 920	$865.00

KEYBOARDS

58 key ASCII keyboard kit	$67.50
Fully assembled	77.50
53 key ASCII keyboard kit	60.00
Fully assembled	70.00
Enclosure Plastic	14.95
Metal Enclosure	29.95

LEDS

Red T013	15
Green, Yellow T018	20
Jumbo Red	20
Green, Orange, Yellow Jumbo	25
Clip-on LED Mounting Clips	8/$1.25
(specify red, amber, green, yellow, clear)	

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip.
WAX-100 6 digit Freq. Ctr. $149.95

DX WIRE WRAP TOOLS in stock
Portable Multimeter $16.00
Complete line of AP Products in stock.

SPECIAL PRODUCTS
MM5865 Stopwatch Timer
with 10 pc. spec. 9.00
PC board 7.50
Switches Mom. Pushbutton .27
3 pos. slide .25
Encoder HD0165-5 6.95
Parallaxics
Model 10 Trigger
Expander Kit $239.00
Model 150 Bus
Grabber Kit $369.00
Clock Calendar Kit $23.95
2.5 MHz Frequency Counter Kit $37.50
30 MHz Frequency Counter Kit $47.75

TRANSFORMERS

6V 300 ma	3.25
12 volt 2 amp wall plug	7.95
12.6 CT 2 amp	5.95
12.6 CT 4 amp	9.45
12.6 CT 8 amp	12.45
12.6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.75
24V CT 100 ma	3.95
10V 1.2 amp wall plug	4.85
12V 6 amp	12.95
12V 500 ma wall plug	4.75
12V 1 amp wall plug	6.50
10.15 VAC 8.16 VA wall plug	9.75

DISPLAY LEDS

MAN1	CA .270	2.95
MAN3	CC .125	.39
MAN6710	CA 300	1.00
DL704	CC 300	1.25
DL707/DL707R	CA 300	1.00
DL727/728	CA/CC 300	1.90
DL747/748	CA/CC 600	1.95
FND338	CC .357	.70
FND500/507	CC/CA 500	1.35
FND503/510	CC/CA 300	.90
FND600/607	CC/CA 600	2.25
3 digit Bubble		.50
10 digit display		1.25
7529 Green photocell		.39
TIL311-Hex		9.50
MAN3640	CC 30	1.10
MAN4610	CA 40	1.20
MAN6640	CC 40	1.20
MAN4710	CA 40	.35
MAN4740	CC 40	1.20
MAN6640	CC 56	2.95
MAN6710	CA 60	1.35
MAN6740	CC 60	1.35

4116 200ns Dynamic RAM
8/$18.40

RCA Cosmac 1802 Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and user's guide. It is easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step.** Large, on board displays provide output and optional **high and low address.** There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM'S use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5 S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Free 14 page brochure. of complete Super Elf system.

Moews Video Graphics **$3.50.** Games and Music **$3.00,** Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface.** Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf.** The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes. **A 1K Super ROM Monitor $19.95** is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel input and Output Ports** with **full handshake.** They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.95, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply).

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range ±.17E**, 32 bit integer ±2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O included.
Super Basic on Cassette $55.00.

Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface $345.00.

1802 16K Dynamic RAM Kit $149.00

Expandable to 64K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$25.00**
Tiny Basic Extended on Cassette $15.00
(Added commands include Stringy, Array, Cassette I/O etc.) S-100 4-slot expansion $ 9.95
Super Monitor V1.1 Source Listing $15.00

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc.
Dealers: Send for excellent pricing/margin program.

Editor Assembler $25.00
(Requires minimum of 4K for E/A plus user source)
1802 Tiny Basic Source listing $19.00
Super Monitor V2.0/2.1 Source Listing $20.00

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00. Tiny Basic $30.00**

S-100 Computer Boards

8K Static Godbout Econo IIA Kit	149.00
16K Static Godbout Econo XIV Kit	269.00
24K Static Godbout Econo XX-24 Kit	414.00
32K Static Godbout Econo XX-32 Kit	537.00
16K Dynamic RAM Kit	289.00
32K Dynamic RAM Kit	328.00
64K Dynamic RAM Kit	399.00
Video Interface Kit	**$161.00**
Color Video Kit	129.95

81 IC Update Master Manual $79.95

Comp. IC data selector, 2 vol. master reference guide. Over 51,000 cross references. Free update service through 1981. Domestic postage $4.75.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. Only $17.00. Article in *June Radio Electronics.*

Gremlin Color Video Kit $69.95

32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. No high res. graphics. On board RF Modulator Kit **$4.95**

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$9.95**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char alphanumeric display, ROM monitor, fully expandable. **$405.00.** 4K version **$450.00.** 4K Assembler **$85.00,** 8K Basic Interpreter **$100.00.**

Special small power supply for AIM65 assem. in frame **$54.00.** Complete AIM65 in thin briefcase with power supply **$499.00.** Molded plastic enclosure to fit both AIM65 and power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$625.00.**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±16v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
$10.00 min. BankAmericard and Master Charge accepted. $1.00 insurance optional.
Postage: Add 5%. C.O.D. $10.00 min. order.

FREE: Send for your copy of our NEW 1981 QUEST CATALOG. Include 46c stamp.

RAMSEY ELECTRONIC'S Inc.

PARTS WAREHOUSE

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Penfield, NY 14526
716-586-3950

We now have available a bunch of goodies too good to bypass. Items are limited so order today.

Call Your Phone Order in Today
TERMS: Satisfaction guaranteed or money refunded. C.O.D. add $2.00. Minimum order $6.00. Orders under $10.00 add $1.50. Add 5% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit $14.95
FM-3 Wired and Tested 19.95

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 $8.95

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 $7.95

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 $2.95

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 $5.95

CPO-1

Runs on 3-12 Vdc 1 wall out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit $2.95

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit $3.95 FM-2 kit $4.95

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC. Complete kit, WL-1 $6.95

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 $5.95

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit $5.95

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC

MB-1 Kit $4.95

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker. Complete kit, SM-3 $2.95

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma) 1 min/month accuracy. TB-7 Kit $5.50
TB-7 Assy $9.95

CLOCK KITS

Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 $24.95
Clock with 10 min. ID timer, 12/24 hour, DC-10 $29.95
Alarm clock, 12 hour only, DC-8 $29.95
12V DC car clock, DC-7 $29.95

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock

The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches. takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify)

DC-3 kit, 12 hour format $22.95
DC-3 wired and tested $29.95

Calendar Alarm Clock

The clock that's got it all: 6- 5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size 5x4x2 inches. Complete kit, less case (not available) DC-9 $34.95

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer atuomatically acuusts display to ambient light level

DC-11 clock with mtg. bracket $27.95 kit
DM-1 dimmer adapter $2.50
Add $10.00 Assy. and Test

Video Terminal

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 6416 is 64 char. by 16 lines, with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 6416, terminal card kit (add $60.00 for wired unit) $189.95
Lower Case option $12.95
Power Supply $14.95
RF Modulator kit $7.95

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

FERRITE BEADS

With info and specs 15/$1.00
6 Hole Balun Beads 5/$1.00

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7851 .43" C.A.	2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/$1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.60
2N2646 UJT	3/$2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge $1.50 each

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ½" leads, bag of 300 or more. $1.50

Switches

Mini toggle SPDT $1.00
Red Pushbuttons N.O. 3/$1.00

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc. 5 for $1.00

Mini 8 ohm Speaker

Approx 2¼" diam. Round type for radios, mike etc. 3 for $2.00

Solid State Buzzers

small buzzer 450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible $1.50

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil 3 turns. 10 for $1.00

AC Outlet

Panel Mount with Leads 4/$1.00

CAPACITORS

TANTALUM Dipped Epoxy		ALUMINUM Electrolytic		DISK CERAMIC	
1.5 uF 25V 3/$1.00		1000 uF 16V Radial	$.50	.01 16V disk	20/$1.00
1.8 uF 25V 3/$1.00		680 uF 20V Axial	$.50	.1 16V	15/$1.00
.22 uF 25V 3/$1.00		150 uF 16V Axial	5/$1.00	.001 16V	20/$1.00
		10 uF 15V Radial	10/$1.00	100 pF	20/$1.00
				.047 16V	20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma $1.25

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

25K 20 Turn Trim Pot $1.00
1K 20 Turn Trim Pot $.50

Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene .50 ea.

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge $.75

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type $1.00

9 Volt Battery Clips

Nice quality clips 5 for $1.00
¼" Rubber Grommets 10 for $1.00

Parts Bag

Asst. of chokes, disc, caps, tant., resistors, transistors, diodes, MICA caps etc. sm. bag (100 pc) $1.00 lg. bag (300 pc) $2.50

Connectors

6 pin type gold contacts for mA-1003 car clock module price .75 ea.

Leds

- your choice, please specify.
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red 8/$1
Mini Yellow, Jumbo Yellow, Jumbo Green 6/$1

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - .50 each or 3/$1.00

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.248800 MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end.

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit $29.95
PS-2 wired $39.95

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify - 10 or -100

Wired, tested, PS-1B $59.95
Kit, PS-1B $44.95

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit $22.95
TR-1, RF sensed T-R relay kit 6.95

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz $11.95

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit $6.95

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 16 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V ct 1 A and 24 VCT.
Complete kit, PS-3LT $6.95

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 10 for $2.00

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size: 1" x ½" shrink to ¼". Great for splices. $9/$1.00

Mini TO-92 Heat Sinks

Thermalloy Brand 5 for $1.00
To-220 Heat Sinks 3 for $1.00

Opto Isolators - 4N28 type $.50 ea.
Opto Reflectors - Photo diode + LED $1.00 ea.

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. .30 strips for $1.00

CDS Photocells

Resistance varies with light, 250 ohms to over 3 meg 3 for $1.00

See List of Advertisers on page 130

SEMICONDUCTORS SURPLUS

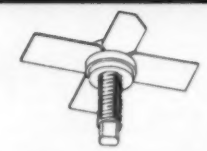
ARCO CAPS

304	100-550pF	1.50	469	170-780pF	1.40
400	.9-7pF	1.00	4615	390-1400pF	2.02
402	1.5-20pF	1.00	404	8-60pF	1.00
420	1-12pF	1.00	405	10-80pF	1.00
423	7-100pF	1.00	422	4-40pF	1.00
426	37-250pF	1.01	424	16-150pF	1.00
464	25-280pF	1.00	427	55-300pF	1.00
465	50-380pF	1.39	462	5-80pF	1.50
467	110-580pF	1.03			

TUBES

6KD6	5.00	6939	7.99
6LQ6/6JE6	6.00	6146	5.00
6MJ6/6LQ6/6JE6C	6.00	6146A	5.69
6LF6/6MH6	5.00	6146B/8298	7.95
12BY7A	4.00	6146W	12.00
2E26	4.69	6550A	8.00
4X150A	29.99	8908	9.00
4CX250B	45.00	8950	9.00
4CX250R	69.00	4-400A	145.00
4CX300A	109.99	4-400C	145.00
4CX350A/8321	100.00	572B/T160L	44.00
4CX350F/J/8904	100.00	7289	9.95
4CX1500B/8660	300.00	3-1000Z	229.00
811A	20.00	3-500Z	141.00
6360	4.69		

RF Transistors



MRF203	P.O.R.	MRF449	12.65	BFR91	1.25
MRF216	19.47	MRF449A	12.65	BFR96	1.50
MRF221	8.73	MRF450	11.00	BFW92A	1.00
MRF226	10.20	MRF450A	11.77	BFW92	.79
MRF227	2.13	MRF452	15.00	MMCM918	14.30
MRF238	10.00	MRF453	13.72	MMCM2222	15.65
MRF240	14.62	MRF454A	21.83	MMCM2369	15.00
MRF245	28.87	MRF455	14.08	MMCM2484	15.25
MRF247	28.87	MRF455A	14.08	MMCM3960A	24.30
MRF262	6.25	MRF474	3.00	MWA120	7.80
MRF314	12.20	MRF475	2.90	MWA130	8.08
MRF406	11.33	MRF476	2.25	MWA210	7.46
MRF412	20.65	MRF477	10.00	MWA220	8.08
MRF421	27.45	MRF485	3.00	MWA230	8.62
MRF422A	38.25	MRF492	20.40	MWA310	8.08
MRF422	38.25	MRF502	.93		
MRF428	38.25	MRF604	2.00	NEW MRF472	
MRF428A	38.25	MRF629	3.00	12.5 VDC, 27 MHz	
MRF426	8.87	MRF648	26.87	4 Watts output	
MRF426A	8.87	MRF901	3.99	10 dB gain	
		MRF902	9.41	1.69 ea.	
		MRF904	3.00	10/9.50	
		MRF911	4.29	100/69.00	
		MRF5176	11.73	1000/480.00	
		MRF8004	1.39		
		BFR90	1.00		

TO-3 TRANSISTOR SOCKETS
Phenolic type.....6/$1.00

NEW SIMPSON 260-7 $99.99

RG174/U - $15.00 per 100 ft.
Factory new

PL259 TERMINATION
52 Ohm 5 Watts $1.50 each

TORIN TA700 FANS NEW $29.99 each
Model A30340
230 VAC @ .78 Amps
Will also work on 115 VAC

CRYSTAL FILTERS

EFCL455K13E	3.99
EFCL455K40B2	2.99
FX-07800L, 7.8 MHz	12.99
FHA103-4, 10.7 MHz	12.99

CB type crystals

$4.95 each

51-T

T1	T15	T28
T2	T16	T29
T3	T17	T30
T4	T18	T31
T5	T19	T32
T6	T20	T33
T7	T21	T34
T8	T22	T35
T9	T23	T36
T10	T24	T37
T11	T25	T38
T12	T26	T39
T13	T27	T40
T14		

51-R

R1	R15	R28
R2	R16	R29
R3	R17	R30
R4	R18	R31
R5	R19	R32
R6	R20	R33
R7	R21	R34
R8	R22	R35
R9	R23	R36
R10	R24	R37
R11	R25	R38
R12	R26	R39
R13	R27	R40
R14		

NEW CHERRY BCD SWITCH
New end plates
Type T-20..... 1.29 each

Johnson AIR Variables

$1.00 each

T-3-5	1 to 5 pF
T-6-5	1.7 to 11 pF
T-9-5	2 to 15 pF
189-6-1	.1 to 10 pF
189-502-Y	1.3 to 6.7pF
189-503-105	1.4 to 9.2pF
189-504-5	1.5 to 11.6pF
189-505-5	1.7 to 14.1pF
189-505-107	1.7 to 14.1pF
189-506-103	1.8 to 16.7pF
189-507-105	2 to 19.3pF
189-508-5	2.1 to 22.9pF
189-509-5	2.4 to 24.5pF
545-043	1.8 to 11.4pF

Johnson AIR Variables

1/4 x 2 1/2" shaft
$2.50 each

193-10-6	2.2 to 34 pF
193-	1.5 to 27.5pF
193-	.6 to 6.4pF

$1.00 each

160-107-16	.5 to 12 pF
193-10-9	2.2 to 34 pF
193-10-104	2.2 to 34 pF
193-4-5	3 to 30 pF

RF Power Device

MRF454 Same as MRF458
12.5 VDC, 3-30 MHz
80Watts output, 12dB gain
$17.95 ea.

E.F. JOHNSON TUBE SOCKETS

#124-0311-100..... 6.99 each
For 8072 etc.

#124-0107-001..... 13.99 each
For 4CX250B/R, 4X150A etc.

#124-0111-001..... 4.99 each
Chimney for 4CX250B/R and 4X150

#124-0113-001 and 124-0113-021
$12.99 each
Capacitor for #124-0107-001

#123-209-33 Sockets....6.99 each
For 811A, 572B, 866, etc.

UNELCO CAPS

MIN. ORDER $10

6.8pF	47pF	
8.2pF	62pF	
10pF	100pF	
12pF	160pF	
13pF	180pF	
14pF	200pF	
20pF	240pF	
24pF	380pF	
33pF	470pF	
36pF	1000pF	
43pF	350V	$1.00 each

86 Pin Motorola Bus Edge Connectors

Gold plated contacts
Dual 43/86 pin .156 spacing
Solder tail for PCB.....$3.00 each

110VAC MUFFIN FANS

New $11.95
Used $5.95

Transistors

2N2857JAN	2.50
2N2949	3.60
2N2947	15.00
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3818	5.00
2N3866	1.00
2N3866JAN	2.50
2N3866JANTX	4.00
2N3925	10.00
2N3948	2.00
2N3950	25.00
2N3959	3.00
2N3960JANTX	10.00
2N4072	1.60
2N4427	1.10
2N4429	7.00
2N4877	1.00
2N4959	2.00
2N4976	15.00
2N5070	8.00
2N5071	15.00
2N5108	4.00
2N5109	1.50
2N5179	1.00
2N5583	4.00
2N5589	6.00
2N5590	8.00
2N5591	11.00
2N5635	5.44
2N5636	11.60
2N5637	20.00
2N5641	5.00
2N5643	14.00
2N5645	10.00
2N5842	8.00
2N5849	20.00
2N5942	40.00
2N5946	14.00
2N5862	50.00
2N6080	7.00
2N6081	10.00
2N6082	11.00
2N6083	13.00
2N6084	14.00
2N6095	11.00
2N6096	20.00
2N6097	28.00
2N6166	38.00
2N6368	22.99
A210/MRF517	2.00
BLY38	5.00
40280/2N4427	1.10
40281/2N3920	7.00
40282/2N3927	10.48

CRYSTALS

$4.95 each

5.120	7.4825	9.565	10.150	11.155	11.905	17.315
7.3435	7.4865	9.575	10.160	11.275	11.955	17.355
7.4585	7.4925	9.585	10.170	11.700	12.000	17.365
7.4615	7.4985	10.000	10.180	11.705	12.050	37.600
7.4625	7.5015	10.010	10.240	11.730	12.100	37.650
7.4665	7.5025	10.020	10.245	11.750	16.965	37.700
7.4685	7.5065	10.030	10.595	11.755	17.015	37.750
7.4715	7.7985	10.040	10.605	11.800	17.065	37.800
7.4725	7.8025	10.0525	10.615	11.850	17.165	37.850
7.4765	9.545	10.130	10.625	11.855	17.215	37.900
7.4785	9.555	10.140	10.635	11.900	17.265	37.950
7.4815						38.000

High Voltage Caps

30 MFD @ 500 VDC	1.69
22 MFD @ 500 VDC	1.69
100 MFD @ 450 VDC	2.29
150 MFD @ 450 VDC	3.29
225 MFD @ 450 VDC	4.29
.001/1000pF @ 10 KV	.89
.001 @ 2 KV	4/1.00
.0015 @ 3 KV	3/1.00
.01 @ 4 KV	.79
.01 @ 1.6KV	4/1.00
.02 @ 8 KV	2.00
.01 @ 1 KV	6/1.00

NEW 2" ROUND SPEAKERS
100 Ohm coil $.99 each

PLASTIC TO-3 SOCKETS
4/$1.00

CRYSTAL FILTERS
Tyco 001-19880 Same as 2194F
10.7 MHz narrow band
3 dB bandwidth 15 KHz min.
20 dB bandwidth 60 KHz min.
40 dB bandwidth 150 KHz min.
Ultimate 50 dB insertion loss 1 dB max.
Ripple 1 dB max. Ct. 0+/-5 pF 3600 Ohms
$3.99 each

78MO5
Same as 7805 but only 1/2 Amp
5 VDC .49 each or 10/$3.00

TRIMMER CAPS

Sprague. Stable Polypropylene.
.50 each or 10/4.00
not sold mixed
1.2 to 13pF
2 to 30pF
3.9 to 18pF
3.9 to 40pF
3.9 to 55pF

Carbide Circuit Board Drill Bits for PCB Boards
5 mix for $5.00

J-Fet

J310 N-CHANNEL J-FET 450 MHz
Good for VHF/UHF Amplifier, Oscillator and Mixers 3/$1.00

MURATA CERAMIC FILTERS

SFD 455D	455 KHz	2.00
SFB 455D	455 KHz	1.60
CFM455E	455 KHz	5.50
CFU455H	455 KHz	3.00
SFE 10.7MA	10.7 MHz	2.99

TEXAS INSTRUMENT TIL-305P
5 x 7 array alphanumeric display
$3.85 each

See List of Advertisers on page 130

SEMICONDUCTORS SURPLUS

ATLAS FILTERS

ATLAS CRYSTAL FILTERS FOR ATLAS HAM GEAR
Your Choice
$15.95 ea.

5.645 - 2.7/8
5.595 - 2.7 USB
5.595 - 2.7/8/L
5.595 - 2.7 LSB
5.595 - .500/4
9.0 - USB/CW

Soldering Kit

New Weller Soldering Iron Kit
#SP-23F..... 9.99 each
Kit includes:
1 - 25 Watt soldering iron, develops 750° of tip temperature
3 - tips (screwdriver, chisel, cone)
1 - soldering aid tool
1 - coil 60/40 rosin core solder

CERAMIC PLATE CAPS

$1.09 each
#1 type for 3/8 plate cap
#2 type for 5/8 plate cap

Used NiCads

Used C Nickel Cadmium Batteries
1.8 amp hour
Pack of ten $8.99 per pack

CERAMIC COIL FORMS
$1.99 each

#1	3/16" x 4/8"
#2	3/16" x 1/4"
#3	1/4 " x 3/4"
#4	3/8 " x 7/8"
#5	3/8 " x 5/8"

All of the above have powdered iron cores.

#6	1/2"x2 3/4"

NEW BOGNER DOWNCONVERTER
Industrial version.
1 year guarantee..... $225.00
NOT FOR SALE IN ARIZONA

UHF/VHF RF POWER TRANSISTORS
CD2867/2N6439
60 Watts output
Reg. Price $45.77
SALE PRICE..... $19.99

CHOKES

.1-3 uH	2.99
VIV .15 .15 uH	2.99
VIV 150 150 uH	2.99
5-20 uH	1.69
Variable coil 10-80 uH	2.99
Transformer dual 8.8 uH	1.00
.47 uH	1.00 ea. or 10/7.50
.68 uH	1.00 ea. or 10/7.50
1 uH	1.00 ea. or 10/7.50
1.2 uH	1.00 ea. or 10/7.50
1.5 uH	1.00 ea. or 10/7.50
2.2 uH	1.00 ea. or 10/7.50
2.7 uH	1.00 ea. or 10/7.50
3.3 uH	1.00 ea. or 10/7.50
6.5 uH	1.00 ea. or 10/7.50
7.5 uH	1.00 ea. or 10/7.50
10 uH	1.00 ea. or 10/7.50
15 uH	1.00 ea. or 10/7.50
20 uH	1.00 ea. or 10/7.50
22 uH	1.00 ea. or 10/7.50
33 uH	1.00 ea. or 10/7.50
39 uH	1.00 ea. or 10/7.50
47 uH	1.00 ea. or 10/7.50
50 uH	2.99
56 uH	1.69
62 uH	1.00 ea. or 10/7.50
68 uH	1.00 ea. or 10/7.50
100 uH	2.99
120 uH	1.69
185 uH	1.00 ea. or 10/7.50
538 uH	1.00 ea. or 10/7.50
680 uH	1.00 ea. or 10/7.50
1000 uH	1.00 ea. or 10/7.50
1630 uH	1.50
.1 mH	2.99
.2 mH	2.99
.22 mH	2.99
.27 mH	2.99
.33 mH	2.99
.39 mH	2.99
.240 mH	2.99
1.2 mH	2.99
1.5 mH	2.99
1.65 mH	2.99
1.75 mH	2.99
1.9 mH	2.99
1 mH	1.69
1.88 mH	3.99
2 mH	2.99
2.4 mH	2.99
2.5 mH	1.00 ea. or 10/7.50
2.7 mH	2.99
3.0 mH	2.99
3.6 mH	2.99
4.3 mH	2.99
4.7 mH	2.99
5 mH	2.99
5.11 mH	2.99
6 mH	2.99
7.2 mH	2.99
8.25 mH	2.99
8.28 mH	2.99
8.6 mH	2.99
10 mH	2.99
12 mH	2.99
15 mH	2.99
17 mH	2.99
19.6 mH	2.99
20 mH	2.99
20.5 mH	2.99
22.6 mH	2.99
24 mH	2.99
27.4 mH	2.99
28.7 mH	2.99
29.9 mH	2.99
30 mH	2.99
36 mH	2.99
36.5 mH	2.99
40 mH	2.99
40.2 mH	2.99
43 mH	2.99
47 mH	2.99
50 mH	2.99
59 mH	2.99
60 mH	2.99
71.5 mH	2.99
78.7 mH	2.99
86 mH	2.99
100 mH	2.99
120 mH	2.99
150 mH	2.99
175 mH	2.99
200 mH	2.99
205 mH	2.99
237 mH	2.99
240 mH	2.99
300 mH	2.99
360 mH	2.99
390 mH	2.99
430 mH	2.99
500 mH	1.50
600 mH	2.99
1000 mH	2.99
1.5 Hy	2.99
2.0 Hy	2.99
2.5 Hy	2.99
3.0 Hy	2.99
5.0 Hy	2.99
10 Hy	2.99

HIGH VOLTAGE CAPS

420 MFD @ 400 VDC	3.99 each
600 MFD @ 400 VDC	3.99 each

New Fairchild Prescaler Chip

95H90DCQM..... 6.50 each
350 MHz prescaler divide by 10/11

1.9-2.5G CONVERTERS

1900 MHz to 2500 MHz DOWNCONVERTERS
Intended for amateur radio use.
Tunable from channel 2 thru 6.
34 dB gain 2.5 to 3 dB noise.
Warranty for 6 months Model HMR 11
Complete Receiver and Power Supply
(does not include coax)..... $225.00

4 foot Yagi antenna only..... $39.99
Downconverter Kit - PCB and parts.. $69.95
Power Supply Kit -
Box, PCB and parts..... $49.99
Downconverter assembled..... $79.99
Power Supply assembled..... $59.99
Complete Kit form $109.99
(includes Yagi antenna and instructions)
REPLACEMENT PARTS
MRF901..... $ 3.99
MBD101..... 1.29
.001 Chip Caps 1.00
Power Supply PCB 4.99
Downconverter PCB..... 19.99
Instructions for any separate item 10.00

NEW TRANSFORMERS

		Price each
F-18X	6.3 VCT @ 6Amps	6.99
F-46X	24V @ 1Amp	5.99
F41X	25.2VCT @ 2Amps	6.99
P-8380	10VCT @ 3Amps	7.99
P-8604	20VCT @ 1Amp	4.99
K-32B	28VCT @ 100 MA	4.99
E30554	Dual 17V @ 1Amp	6.99

DIODES

HEP 170
3.5 A, 1000 PIV
.20 ea., 100 for $15.00

D61005
1.5 A, 1000 PIV
.15 ea., 100 for $12.00

HVK 1153
25 mA, 20,000 PIV
$1.00 ea., 10 for $8.00

Fairchild LEDs
FLV 5007 & 5009 red.
Case type TO-92.
6/$1.00

SCMS 10K
15 mA, 10,000 PIV
$1.69 ea., 10 for $12.50

High-voltage diode EK500
5000 Volts, 50 mA
.99 each

Motorola SCR
TO-92 Case, 0.8 Amp, 30 V.
Igt 0.2 Vgt 0.8.
Same as #N5060.
4/$1.00 or 100/$15.00

Dialco Type 555-2003
LED 5 VDC with built-in resistor.
.69 each

Motorola MA 752 Rectifier
6 Amps, 200 PIV
4/$1.29

NEW BCD SWITCH
8 switch with end plates
Model TSM200-1011 (CDI) $16.87

CONTINUOUS TONE BUZZERS
12VDC..... $2.00 each

EIMAC FINGER STOCK #Y-302
36 in. long x 1/2 in. $4.99 each

MAGNET WIRE
$22.50 per spool

#24	A.W.G.	9 lb.
#26	A.W.G.	9 lb.
#25	A.W.G.	9 lb.
#30	A.W.G.	8 3/4 lb.
#31	A.W.G.	6 lb.

CORES
4/1.00

T20-12	T30-6	T37-6
T25-6	T30-12	T37-10
T30-2	T37-2	T44-6

CABLE TIES
#/T-18R 100 per bag
mil. spec. #MS-3368S, 4"
Made by Tyton Corp.
$2.50 per bag
100 bags - $20.00

Miniature Ceramic Trimmers
.50 each or 10/$4.00

CV31D350	2 to 8 pF
HM00-4075-03	3.5 to 11 pF
300425	3.5 to 13 pF
E5-25A	5 to 25 pF
	5.1 to 40 pF
	3.5 to 15 pF
	5.2 to 40 pF
	2.5 to 6 pF

CERAMIC STAND OFFS

#CNP-5	3/8 x 5/8"	.29 each
	7/16 x 1 1/4"	.39 each
#N54W0112	3/8 x 1 1/2"	.49 each
#NL523W03-010	3/4 x 1 1/4"	.79 each

CORES AND BEADS

#43	Shield Bead	4/1.00
#61	Toroid	3/1.00
#43	Balun	10/1.00
#61	Balun	8/1.00
#61	Balun	6/1.00
#61	Balun	4/1.00
#61	Beads	10/1.00
Ferrite Rod 1/4 x 7 1/2		2.99
Ferrite Beads 1/8" long		12/1.00
Ferrite Beads 3/8" long		6/1.00
Ferrite Beads 1/16" long		12/1.00

DOOR KNOB CAPS

470 pF @ 15 KV	$3.99 each
Dual 500 pF @ 15 KV	5.99 each
680 pF @ 6 KV	3.99 each
800 pF @ 15 KV	3.99 each
2700 pF @ 40 KV	5.99 each

TRANSFORMERS
$9.99 each
#2899652-01
26.8 VCT @ 660 MA
21.9 VCT @ 1.1 Amps
$1.99 each
#18000711P
24 V @ 100 MA
$12.99 each
#2099459-00
28 V @ 1.5 Amps
9.6 V @ 9 Amps
16.8 V @ 300 MA

JUMBO LED'S

Red	8/$1.00
Clear	6/$1.00
Yellow	6/$1.00
Green	6/$1.00
Amber	6/$1.00

MEDIUM LED'S

Red	6/$1.00
Green	6/$1.00

NE555V TIMERS
.39 each or 10/$5.00

NEW DUAL COLON LED
.69 each or 10/$5.00

PLATE CHOKES

75 uH	3.00
.94 mH	3.99

TRANSISTORS/IC'S

Motorola MHW 252 VHF power amplifier.
Frequency range: 144-148 MHz.
Output power: 25W.
Minimum gain: 19.2 dB.
$29.67 each

Motorola MC 1316P.
House no. same as HEP C6073 & EC9814.
2-W audio amplifier.
$1.29 ea., 10 for $9.50

Fairchild 007-03 IC.
ECG no. 707 Chroma demodulator.
$1.29 ea., 10 for $8.50

Motorola rf transistors.
Selection Guide & Cross-Reference Catalog.
43 pgs.
$1.99 each

RCA Triacs.
Type T2310A.
TO-5 Case with heat sinks.
1.6 Amp, 100 VDC, Igt 3mA.
Sensitive gate.
$1.00 each

RCA power transistors.
NPN RCS 258.
Vceo 60 NFE 5mA.
IC 20 Amps Vce 4V.
250 Watts, Ft 2 MHz.
$3.00 each

RCA Triacs.
Type T4121B/40799.
200 VDC 10 Amps.
Stud type.
$3.69 each

RCA Triacs.
Type 40805/T6421D.
30 Amps, 400 VDC.
$5.00 each

Motorola rf amplifier.
544-4001-002, similar to type MHW 401-2.
1.5 Watts output. 440-512 MHz.
15 dB gain min. $19.99 each

ORDERING INSTRUCTIONS

Check, money order, or credit cards welcome. (Master Charge and VISA only.) No personal checks or certified personal checks for foreign countries accepted. Money order or cashiers check in U.S. funds only. Letters of credit are not acceptable.

Minimum shipping by UPS is $2.35 with insurance. Please allow extra shipping charges for heavy or long items.

All parts returned due to customer error or decision will be subject to a 15% restock charge. If we are out of an item ordered, we will try to replace it with an equal or better part unless you specify not to, or we will back order the item, or refund your money.

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. Prices supersede all previously published. Some items offered are limited to small quantities and are subject to prior sale.

We now have a toll free number, but we ask that it be used for *charge orders only*. If you have any questions please use our other number. We are open from 8:00 a.m. - 5:00 p.m. Monday thru Saturday.

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The **SE-01 Sound Effects Kit has** all you need to build a programmable sound effects machine except a battery and speaker. Only the SE-01 provides you with additional circuitry that includes a **Pulse Generator, Mux Oscillator and Comparator** to make more complex sounds a snap. **Includes TI76477,** (w/specs) assembly instructions and programming examples. You can easily create **Gunshots, Explosions, Steam Trains, Wind & Surf** and much more.

Complete Kit $18.50
With quality PC Board
(Less battery & spkr.)
76477 Chip is included
Extra chips $3.15 ea.

★ ZULU II Clock Kit ★

$19.95 LESS CASE

- 1/2" LED Readouts
- Quartz XTAL Timebase
- Calendar
- Unique NOX™ Circuit Will Display Readouts On Handclap
- Battery Backup (battery not included)
- High Quality Drilled & Plated PC Boards; Clear Instructions

★
PLASTIC CASE WITH FRONT & REAR PANELS FOR ZULU II $4.95.★

New! ★Doomsday Alarm ★

If you have trouble sleeping and you would like the rest of the neighborhood to share your misery then this little kit will be for you! There is no way to accurately describe the unearthly howls, screams and tones that come out of this kit. Four separate tone oscillators are mixed, cancelled and stepped at a varying rate. 10 Watts of crazy sounds. A great fun kit or a practical burglar alarm. Complete with PC board and all necessary components less speaker. For 6–12 VDC.

9.95 KIT ORDER ***DA-02***

7 Watt Audio Amp Kit $5.95

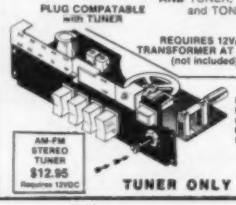
SMALL, SINGLE HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT.

Overvoltage Protection Kit $6.95

Protect your expensive equipment from overvoltage conditions. Every computer should have one! **Works with any fused DC power source** from 10 to 20 volts up to 25 amps.

Stereo AMP/Power Supply Board

Takes low level audio and drives 8 ohm speakers ON-BOARD Rectifiers and Filter supply power for AMP **AND** TUNER, VOLUME, BALANCE, and TONE SLIDE CONTROLS.



$6.95
AMP ONLY

FEATURES: AM, FM Stereo, Phono Input, Aux Input, AC Cord, 300 Ohm Antenna Input AM Loopstick Antenna, Standard Turntable Plugs.
BUY 3 SETS (Tuner Amp combos) for $50.00

See Special Fall Prices Below

Prices good thru Nov. 30, 1981

SHOP EARLY FOR CHRISTMAS!

The Super Music Maker
REVISION 2
$24.95
(Basic Kit)
Does not include speaker switches or 2708 ROM

Now you can play hundreds of songs using the Bullet **Super Music Maker.** The unit **features a single factory programmed microprocessor** IC that comes with 20 pre-programmed short tunes. By adding the additional PROMS (2708's) the system can be expanded to play up to **1000 notes per PROM.** Just think . . . a compact electronic instrument that will play dozens, hundreds or even thousands of selections of music. The kit comes with **all electronic components (less the PROM),** and a drilled, plated and screened PC Board which measures 4" x 4½". The **7 watt amplifier** section is on the same PC board and drives an 8 ohm speaker (not included), from a whisper to ear splitting volume. Since the unit works on **12 VDC** or **12 VAC*,** vehicle or portable operation is possible. **What do you get for $24.95? Everything but a speaker, transformer, case, switches,** and **PROM.** Additional 2708 albums containing popular tunes are available for **$15.00** each or you can program your own PROMS using information provided with the kit instructions. Lists of available PROM albums are available on request. *(Note: Unit plays electronic music one note at a time, it is not possible to play chords or a melody with harmony simultaneously.)*

- Envelope control gives decay to notes.

★ On board inverter allows single voltage (+12) operation.

OPTIONAL ACCESSORIES

DIP Switches	One 8 pos., One 5 pos. (Can be **directly soldered** to PC Bd. to access tunes)	**2.00/Set**
Rotary Switches	Two 5 position (For **remote wiring** to PC Bd. to access tunes)	**2.50/Set**
Attractive Plastic Case		**6.50**
Wallplug Transformer	(For operation on 117VAC house voltage)	**3.00**

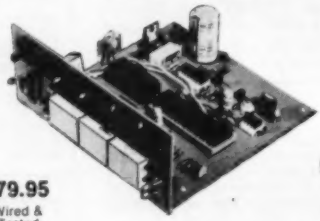
Microprocessor Station Clock $49.95

The **ZULU 3TZ** is a full blown **ROM** and **MICRO-PROCESSOR** unlike other standard clock IC's, it allows exceptional flexibility. Almost a year in design, it is **the most advanced station clock on the market.**

Adjustable Brightness
.6" - High Intensity Orange Led Readouts
Seconds Reset/Hold provides easy syncronization with WWV

Quartz Crystal Timebase and **Battery Backup**

QUALITY SOLDER MASKED & SCREENED PC BOARDS MAKES ASSEMBLY A SNAP



ZONE CHANGE FEATURE
Select one of **three World Time zones,** Local Time (12 Hr. format) and **TWO** 24 hr. zones of your choice.

RFI Protected

ID FEATURE
LED Indicator lights when activated flashes at 10 min. Different audio tones at 8 and 9 min.

$49.95 Complete Kit Including Case & Wallplug XFMR for 117VAC Operation

$79.95 Wired & Tested

12 Volts AC or DC

FALL SPECIALS: (Good Thru Nov. '81)

1. Super Music Maker with case and two 5-position rotary switches **$32.00**
2. Super Music with one 2716 2K X 8 PROM filled with over 50 selections of additional music (>1500 notes) **$32.00**
3. The Whole Ball of Wax! #2 + case and switches. **$39.95**

PS 14 REGULATOR CARD KIT

This is the Regulator Card from our famous **20A Power Supply Kit.** Although we ran out of the transformers and heatsinks, many customers have been able to locate their own. The regulator card performs the actual voltage regulation and has adjustable fold back current limiting. Output voltage **is stable to 200MV from 0 to 20 Amps and adjustable from 11 to 14 Volts.** Designed to drive 2 high current NPN transistors (2N3771 2N5301 or equiv.) The unit assembles quickly. Included are all the on board components including a driver transistor and over-temp shutdown sensor. Designed to screw down to a standard 3" diameter computer grade filter cap. The quality plated PC card is 3-1/2" x 4 3/4".

WITH INSTRUCTIONS

REGULATOR CARD KIT **$14.95**
HIGH CURRENT PARTS
(2 - 2N3772 & 25A Bridge) **$5.00**
51,000 MFD @ 40V Computer Grade **$3.50**

Requires Transformer with 16 - 19 VAC Out @ The Current You Expect To Draw.

- **NO C.O.D.'s.**
- **SEND CHECK M.O. OR CHARGE CARD NO.**
- **PHONE ORDERS ACCEPTED ON VISA AND MASTERCHARGE ONLY.**
- **ADD 5% FOR SHIPPING.**
- **TX. RES. ADD 5% STATE SALES TAX.**
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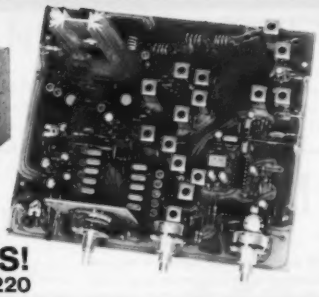
QUALITY VHF/UHF KITS AT AFFORDABLE PRICES

-NEW-



SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

10 watts, 5 Channels, for 6M, 2M, or 220

Hamtronics® Does it Again!

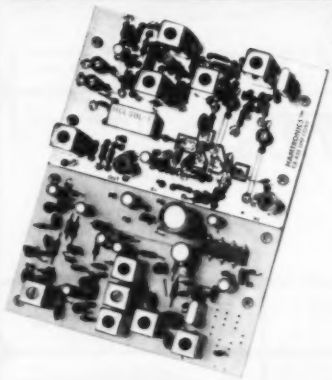
Where else can you get a value-packed radio at such reasonable cost?

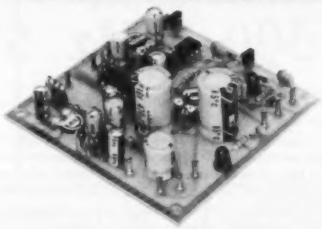
FM-5 PC Board Kit – ONLY $159.95
complete with controls, heatsink, etc.

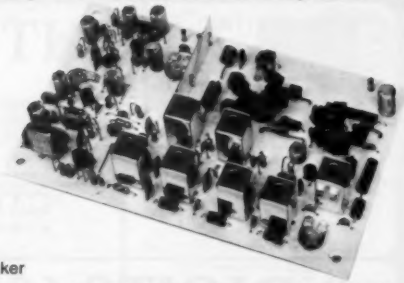
Cabinet kit, microphone, crystals, etc. available separately

Request catalog for full details.

HIGH QUALITY FM MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.







- **R75 VHF FM RECEIVER** for 10M, 6M, 2M, 220, or commercial bands. 4 fantastic selectivity options. Kits from $84.95 to $119.95
- **R450 UHF FM RECEIVER** for 380-520 MHz bands. Kits in selectivity options from $94.95
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- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.
- **SCANNER CONVERTERS** Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $54.95.
- **T451 UHF FM EXCITER** for 450 ham band or adjacent. Kits only $64.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

VHF & UHF TRANSMITTING CONVERTERS

For SSB, CW, ATV, FM, etc. Available for 6M, 2M, 220, 440 with many IF input ranges. Converter board kit only at $79.95 (VHF) or $99.95 (UHF) or kits complete with PA and cabinet as shown.

VHF & UHF RECEIVING CONVERTERS

20 Models cover every practical rf and if range to listen to SSB, FM, ATV, etc. on 6M, 2M, 220, 440, and 110 aircraft band. Even convert weather down to 2M! Kits from $39.95 and wired units.

VHF & UHF RECEIVER PREAMPS. Low noise.

VHF Kits from 27 to 300 MHz. UHF Kits from 300 to 650 MHz. Broadband Kits: 20-650 MHz. Prices start at $14.95 (VHF) and $18.95 (UHF). All preamps and converters have noise figure 2dB or less.

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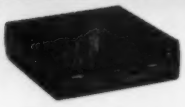

9 DIGITS 600 MHz $129.95 WIRED

PRICES	
CT-90 wired, 1 year warranty	$129.95
CT-90 K.it, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

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DIGITAL RESEARCH: PARTS

"TOP QUALITY PARTS FOR LESS"

Precision Hybrid Oscillator Module

Has both 1 MHZ and 2 MHZ TTL - outputs — Hermetically sealed — Ultra high stability over wide temp. range — originally cost over $40.00 each — We made a super purchase from a major computer manufacturer — 5 Volt operation - fits standard 24 pin socket - Manufactered by Motorola oscillator division.

MC6871A

3/20.00

7.50 w/data

NEO 2137 by NEC

- Microwave R.F. transistor (N.P.N.)
- Micromold package #37
- Dual Emitter leads
- FT to 4.5 GHZ
- VCEO 10V-CC 20 MA. HFE 40-200
- Gain 10V-20MA-1GHZ = 14DB Typical
- Very low noise - High gain 1.5 DB @ 500 MHZ
- Cleared for high reliability space applications

COMPARE **1.50**

LM117

An easy to use adjustable Voltage Regulator - only two external resistors needed to set the output voltage - TO-3 Case - adjustable from 1.2 to 37V - Regulator is floating, so it can be used in a wide variety of applications, as long as the input-to-output differential voltage is 40V or less - 1.5A output current - house numbered - prime - Motorola.

1.75

Video Game Board

Hockey • Tennis • Handball

- General Instruments AY3-8500
- Features Exciting Sounds
- On Screen Scoring
- 1 or 2 Players
- Speed & Paddle Controls
- Works on 9 Volts D.C.

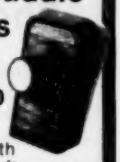
Each board comes with RF Modulator (Ch. 3 or 4) and schematic. The only parts needed to complete game are speaker, 2-1 Meg Pots & Switches.

4.45

3 for 12.00

Video Paddle Controls

2 for 1.00



Can be used with game board at left.

Rectifier Diode

IN4007

11/1.00

1000 Volts, 1 Amp
DO-41 Case • Prime •
Long Lead • Marked.

Transformer

32VCT @ 1 amp
6V @ 1 amp

3.25

Measures:
2" x 2¼" x 2¼"
2⅜" Mounting Centers

SCOTCH LOK

Great for connecting a wire to an existing wire without stripping. Absolutely invaluable in hard to reach areas such as under car dash, inside television, etc. Simply put Scotch Lok over existing wire. Insert new wire to be connected. With a standard pair of pliers, compress metal on insulator. No need for tape. Super neat installation. Once you use this, you will never go back to the "old" way.

15/1.00

IC Specials

MC1488-1489 - RS232 Driver and Receiver **99¢ pr.**

NE556-Dual NE555

2/1.25

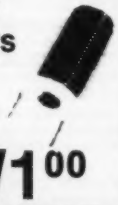
NE555

3/1.25 or 10/3.30

Variable Inductors

30-40 uh
.9 uh - 1.2 uh
11 uh to 20 uh
.25 uh - .35 uh
.85 uh - .95 uh

4/1.00



Micro Mini Toggle Switch

99¢

6 for 5.00

SPDT • Made in USA with Hardware

JFET OP AMP

Super High Input Impedance (10^{12} OHMS) — High Frequency Response. TO 4 MHZ. Large DC Voltage Gain 106 DB — New generation OP-AMP with Vastly Superior Features!

LF356BH - **75¢ or 3/2.00**

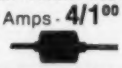
MA1010A Clock Module

- Giant .84" LED
- Complete - add only transformer and switches
- 12 hour display format
- 50 or 60 HZ operation
- Power failure indication
- Fast and slow set controls
- Brightness control capability
- PM indicator

4.25

Fixed Inductors

.39 uh - **6/1.00** 12.5 uh - **8/1.00**
500 uh - Hash Filter
@ 2 Amps - **4/1.00**



Molded Choke

13 uh - **8/1.00** 50 mh - **6/1.00**
1.2 mh - **8/1.00**

5 Watt Zeners

6.8v 15v 48v
11v 24v 55v
12.6 v 30v 60v

5% • Some House Numbered Cut & Formed • Prime

10 for 1.00

IN4735 • 6.2V • 1 Watt
Cut & Formed **20/1.00**

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NEC #4981-7E
Microwave - Schottky barrier diode

HP-Hot Carrier diodes
5082-2835

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SEE WHAT BILLY BOB HAS TO SAY ON PAGE 18 OF OUR NEW CATALOG!

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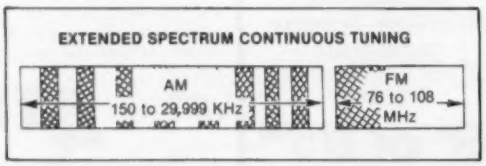
- **Instant Fingertip Tuning—No More Knobs!**
- **6 Memories for Any Mode (AM,SSB/CW, & FM)**
- **Dual PLL Frequency Synthesized—No Drift!**

A WHOLE NEW BREED OF RADIO IS HERE NOW! No other short wave receiver combines so many advanced features for both operating convenience and high performance as does the new Sony ICF-2001. Once you have operated this exciting new radio, you'll be spoiled forever! Direct access tuning eliminates conventional tuning knobs and dials with a convenient digital keyboard and Liquid Crystal Display (LCD) for accurate frequency readout to within 1 KHz. Instant fingertip tuning, up to 8 memory presets, and continuous scanning features make the ICF-2001 the ultimate in convenience.

Compare the following features against any receiver currently available and you will have to agree that the Sony ICF 2001 is the best value in shortwave receivers today:

DUAL PLL SYNTHESIZER CIRCUITRY covers entire 150 KHz to 29.999 MHz band. PLL_1 circuit has 100 KHz step while PLL_2 handles 1 KHz step, both of which are controlled by separate quartz crystal oscillators for precise, no-drift tuning. **DUAL CONVERSION SUPERHETERODYNE** circuitry assures superior AM reception and high image rejection characteristics. The 10.7 MHz IF of the FM band is utilized as the 2nd IF of the AM band. A new type of crystal filter made especially for this purpose realizes clearer reception than commonly used ceramic filters. **ALL FET FRONT END** for high sensitivity and interference rejection. Intermodulation, cross modulation, and spurious interference are effectively rejected. **FET RF AMP** contributes to superior image rejection, high sensitivity, and good signal to noise ratio. Both strong and weak stations are received with minimal distortion.



A Enter Button
B Signal Strength Indicator
C Liquid Crystal Display
D Memory Preset Buttons
E Antenna Adjustment Dial
F SSB/CW Compensator
G Execute Bar
H Manual Tuning Buttons
I Scan Button
J High/Low Limit Buttons

OPERATIONAL FEATURES

INSTANT FINGERTIP TUNING with the calculator-type key board enables the operator to have instant access to any frequency in the LW, MW, SW, and FM bands. And the LCD digital frequency display confirms the exact, drift-free signal being received. **AUTOMATIC SCANNING** of the above bands. Continuous scanning of any desired portion of the band is achieved by setting the "L_1" and "L_2" keys to define the range to be scanned. The scanner can stop automatically on strong signals, or it can be done manually. **MANUAL SEARCH** is similar to the manual scan mode and is useful for quick signal searching. The "UP" and "DOWN" keys let the tuner search for you. The "FAST" key increases the search rate for faster signal detection. **MEMORY PRESETS.** Six memory keys hold desired stations for instant one-key tuning in any mode (AM, SSB/CW, and FM), and also, the "L_1" and "L_2" keys can give you two more memory slots when not used for scanning. **OTHER FEATURES:** Local, normal, DX sensitivity selector for AM; SSB/CW compensator; 90 min. sleep timer; AM Ant. Adjust.

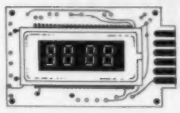
SPECIFICATIONS

CIRCUIT SYSTEM: Fm Superheterodyne; AM Dual conversion superheterodyne. **SIGNAL CIRCUITRY:** 4 IC's, 11 FET's, 23 Transistors, 16 Diodes. **AUXILIARY CIRCUITRY:** 5 IC's, 1 LSI, 5 LED's, 25 Transistors, 9 Diodes. **FREQUENCY RANGE:** FM 76-108 MHz; AM 150-29,999 KHz. **INTERMEDIATE FREQUENCY:** FM 10.7 MHz.; AM 1st 66.35 MHz., 2nd 10.7 MHz. **ANTENNAS:** FM telescopic, ext. ant. terminal; AM telescopic, built-in ferrite bar, ext. ant. terminal. **POWER:** 4.5 VDC/120 VAC **DIMENSIONS:** 12¼ (W) X 2¼ (H) X 6¾ (D). **WEIGHT:** 3 lb. 15 oz. (1.8 kg)

SPECTRONICS, INC.
1009 GARFIELD ST. OAK PARK, IL. 60304
PHONE (312)848-6777

National Semiconductor Clock Modules

12VDC AUTOMOTIVE/ INSTRUMENT CLOCK



APPLICATIONS:
- In-dash autoclocks
- After-market auto/ RV clocks
- Aircraft-marine clks.
- 12VDC oper. instru.
- Portable/battery powered instruments.

Features: Bright 0.3" green display. Internal crystal time-base. ± 0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete—just add switches and lens.

MA1003 Module (3.05"L x 1.75"Hx.98"D) . **$16.95**

CLOCK MODULES

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MA1026 .7" Dig. LED Alarm Clock/Thermometer	18.95
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MA1010 .8" Red Digital LED Clock	7.95
MA1032 CBA .5" Digital LCD Clock	17.95
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TRANSFORMERS

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102-P22 Xformer for MA1026 Clock Modules	3.49
102-P24 Xformer for MA1010 Clock Modules	3.49

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2¼" – 8 Ohm – .25 watt
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BATTERY HOLDER
- Holds 2 ea. C cells
- Aluminum Case
- 5" leads

$ .45 each BH-801-159 10/$3.95

BATTERY HOLDER
- Holds 4 ea. C cells
- Plastic case
- 9" leads

$ .49 ea. 10/$4.25
BH82721

EPROM Erasing Lamp

- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact – only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

UVS-11EL Replacement Bulb $16.95

UVS-11E $79.95

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JS-6K	5K Linear Taper Pots	$5.25
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6-Digit Clock Kit

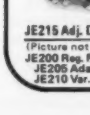
- Bright .300 ht. comm. cathode display
- Uses MM5314 clock chip
- Switches for hours, minutes and hold modes
- Hrs. easily viewable to 20 ft.
- Simulated walnut case
- 115 VAC operation
- 12 or 24 hr. operation
- Incl. all components, case & wall transformer
- Size: 6⅛" x 3-1/8" x 1⅝"

JE701 . . . . . $19.95

JE215 Adjustable Dual Power Supply

NEW!

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.



FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2" w x 5-1/16" L x 2" H

JE215 Adj. Dual Power Supply Kit (as shown) . . $24.95

(Picture not shown but similar in construction to above)

JE200 Reg. Power Supply Kit (5VDC, 1 amp) . .	$14.95
JE205 Adapter Brd. (to JE200) ±5,±9 & ±12V.	$12.95
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DP8225	Bus Driver	3.49
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DP8875	System Controller	5.95
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M-COP1800	User Manual	7.95
M-2650	User Manual	9.95

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DS8052CN	Dual MOS Clock Driver (8MZ)	3.95
DS8052CN	Dual MOS Clock Driver (8MZ)	1.95
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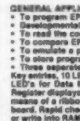
74C922	Keyboard Encoder (20 keys)	3.49
74C923	Keyboard Encoder (42 keys)	5.95
MM5232BN	Push Button Pulse Dialer	7.95
MM5740WN	96/104-Key Serial Keyboard Encoder	8.95

ELECTRONIC TOY MOTORS

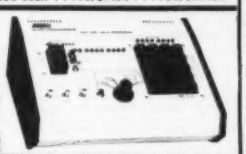


.937 O.D. X 1.201 Length

Typical Power Source	Operating Voltage Range	TYPICAL CHARACTERISTICS NO LOAD Voltage	NO LOAD Speed (RPM)	NO LOAD Current	AT MAXIMUM EFFICIENCY Speed (RPM)	AT MAXIMUM EFFICIENCY Current	AT MAXIMUM EFFICIENCY Torque (OZ. IN.)	AT MAXIMUM EFFICIENCY Output (W)	AT MAXIMUM EFFICIENCY Eff. (%)	STALL TORQUE (OZ. IN.)
DRY CELL	1.5-6.0	3.0	9,200	0.20	6,750	0.90	0.260	1.30	57.0	0.97

MABUCHI RE280 **$ .99 each . . .10/$7.50 . . .100/$50.00**

JE608 PROGRAMMER
2704/2708 EPROM PROGRAMMER



GENERAL APPLICATIONS:
- To program EPROMS 2704 and 2708.
- Developmental system for microcomputer circuits.
- To read the contents of a pre-programmed EPROM
- To compare EPROM(s) for content differences
- To emulate a programmed EPROM
- To store program in RAMS for alterations
- Three separate Display Registers: 8 LED's for Hex Key entries, 10 LED's (2^3) for Address Register and 8 LED's for Data Memory Register. The Data Memory Register displays the content of the RAMs from the EPROM Chip. Development of microprocessor systems by means of a ribbon cable from the programmer panel test socket to the EPROM socket on the microprocessor board. Rapid checking verification of programmed data changes. User may move data from a master to RAM's or write into RAM's with keyboard entries. Allows manual step-by-step manipulation (up and down) at any address location. Stand-alone EPROM Programmer consisting of: A 19-key Hexadecimal Keyboard assembly, Programmer Board assembly with 4 power supplies and a LED/Test Socket Panel Board assembly. The Test Socket is zero force insertion type. Power requirements: 115VAC, 60Hz, 9W. Compact desk-top enclosure. Color-coordinated designer's case with light tan panels and molded end pieces in mocha brown. Size: 3¼ "H x 11"W x 8¼"D. Weight: 5 lbs.

The JE608 EPROM Programmer is a completely self-contained unit which is independent of computer control and requires no additional systems for its operations. The EPROM can be programmed from the Hexadecimal Keyboard or from a pre-programmed EPROM. The JE608 Programmer can emulate a pre-programmed EPROM by means of its internal RAM circuits. This will allow the user to test or protest a program for a system, prior to programming a chip. Any changes in the program can be entered directly into the memory circuits with the Hexadecimal Keyboard so that reprogramming the entire program will not be necessary. The JE608 Programmer contains a Programmer/Board w/2Ss IC's & it includes power supplies of: -5V, +5V, +12V and +26V. The Hexadecimal Keyboard and LED/Test Socket Panel board are separate assemblies within the system.

JE608K Kit $399.95

JE608A Assembled and Tested $499.95

JE608-16K ADAPTER BOARD
FOR 2716/2758 EPROMS

GENERAL DESCRIPTION:
The JE608-16K Adapter Board allows the JE608 Programmer to be modified for the additional programming of the 2716 and 2758 EPROMS. The adapter provides for adding an address switch for the 2^11 bit and also for selecting the proper power and timing pulses to be applied to the EPROM. Programming and simulating the 2716 (16K) EPROM is done separately to each half (1024x8) of the EPROM because of the existing 8K RAM capacity in the JE608 Programmer.

JE608-16K	Adapter Board Kit $29.95
JE608-Upgrade	(Send assembled JE608 to factory for adapter installation . . . . . $99.95 of the JE608-16K Adapter Board Kit)
JE608A-16K Mod.	Assembled JE608 w/Adapter (JE608-16K) installed $599.95

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30001	National CMOS Data Book (640 pages) 74C, CD4000, and A/D Converters	16.95
30002	National Interface Data Book (704 pages) DP, DS8000, DS3800, DS7800, etc.	16.95
30003	National Linear Data Book (1376 pages) LM, LF, ADC, DAC, LH Series	27.95
30004	National Series 80 — Board Level Computer (224 pages)	14.95
30005	National TTL Logic Data Book (604 pages) 7400, LS, H, S, and CD4000 Series	16.95
30000S	Buy above (5) 30001,2,3,4,5 as a set	624.95/set
30000	Intersil Data Book (1074 pages)	16.95
010400	Intel Component Data Catalog	10.00
	Full data sheets for Intel's products, incl. memory devices, microproc., peripherals & indust./mil. products (1328 pages)	
230410	Intel Peripheral Design Handbook	17.50
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AC and DC Wall Transformers

Ideal for use with clocks, games, power supplies or any other type of AC or DC application.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12 VAC 250mA	$3.95
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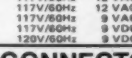
AC1000	117V/60Hz	12 VAC 1 amp	$5.95
AC1700	117V/60Hz	9 VAC 1.7 amp	$3.95
DV 9200	117V/60Hz	9 VDC 200mA	$3.25
DC 900	120V/60Hz	9 VDC 500mA	$3.95

CONNECTORS



DB25P	D-Subminiature Plug	$2.95
DB25S	D-Subminiature Socket	$3.50
D20418-2	Screw Lock Hdwr. (2) DB25S/P	2/$.99
DB51226	Cover for DB25P/S	$1.75
22/44SE	P.C. Edge (22/44 Pin)	$2.95
UG88/U	BNC Plug	$1.79
UG89/U	BNC Jack	$3.79
UG175/U	UHF Adapter	$ .49
SO239	UHF Panel Recp.	$1.29
PL258	UHF Adapter	$1.60
PL259	UHF Plug	$1.80
UG260/U	BNC Plug	$1.79
UG1094/U	BNC Bulkhead Recp.	$1.29

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
★ 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
★ Documentation for Conversion

TRS-16K2 *150NS	$29.95
TRS-16K3 *200NS	$24.95
TRS-16K4 *250NS	$19.95

JE610 ASCII Encoded Keyboard Kit

The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-key), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and –12V @ 10 mA for operation. Features: 60 keys generate the 128 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3½"H x 14⅜"W x 8¾"D

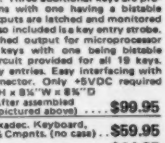
JE610/DTE-AK (After assembled as pictured above) . . . **$124.95**

JE610 Kit	62-Key Keyboard, PC Board, & Components (no case). . . . $ 79.95
K62	62-Key Keyboard (Keyboard only) . . . $ 34.95
DTE-AK	(case only — 3¼"Hx11"Wx8¾"D) $ 49.95

NEW!! JE212 — Negative 12VDC Adapter Board Kit for JE610 ASCII KEYBOARD KIT. Provides -12VDC from incoming 5VDC . . . $8.95

JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT
19-KEY KEYBOARD



The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3¼"H x 8¼"W x 8¾"D

JE600/DTE-HK (After assembled as pictured above) **$99.95**

JE600 Kit	19-Key Hexadec. Keyboard, PC Board & Cmpnts. (no case) . . $59.95
K19	19-Key Keyboard (Keyboard only) $14.95
DTE-HK	(case only — 3¼"Hx8¼"Wx8¾"D) $44.95

✓See List of Advertisers on page 130

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the December issue must be in our hands by October 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

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Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	7A	7	7	7	7	7	7	14	14	14A	21A
ARGENTINA	14	14	7	7	7	7	14	21	21A	21A	21	21
AUSTRALIA	21	7A	7B	7B	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	14A	7	7	7	7	7	7	14	21	21A	21A	21
ENGLAND	7A	7	7	7	7	7	14	21	21A	21A	14	14
HAWAII	21	14	7B	7	7	7	7	7B	14	21	21	21A
INDIA	7	7B	7B	7B	7B	7B	7A	14A	14	14	14	7A
JAPAN	14A	14	7B	7B	7B	7	7	7B	7B	7B	14	21A
MEXICO	14	7A	7	7	7	7	7	14	14A	21A	21A	21
PHILIPPINES	14A	14	7B	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	7A	7	7	7	7	7	7A	14	21A	21A	21	14
SOUTH AFRICA	14	14	7	7B	7B	7	14	21	21A	21A	21	14A
U. S. S. R.	7	7	7	7	7B	7A	21	21A	14	14	14	7
WEST COAST	21	7A	7	7	7	7	7	14	21	21A	21A	21

CENTRAL UNITED STATES TO:

ALASKA	21	14	7	7	7	7	7	7	14	14	21	21A
ARGENTINA	21	14	7	7	7	7	7A	14	21A	21A	21	21
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	14A	14	7	7	7	7	7A	14	21	21A	21A	21
ENGLAND	7	7	7	7	7	7	7	14	21A	21	14	14
HAWAII	21A	14	7B	7	7	7	7	7	14	21	21A	21A
INDIA	14	7	7B	7B	7B	7B	7B	14	14	14	14	14
JAPAN	21A	14	7B	7B	7B	7	7	7	7B	7B	14	21A
MEXICO	14	7	7	7	7	7	7	14	14A	21	21A	21
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7	14	14	14	14A
PUERTO RICO	14A	14	7	7	7	7	7A	14	21	21A	21A	21
SOUTH AFRICA	14	7	7	7B	7B	7B	7	14	21	21A	21A	21
U. S. S. R.	7	7	7	7	7B	7B	7B	14	21	14	14	7B

WESTERN UNITED STATES TO:

ALASKA	21	14	7A	7	7	7	7	7	7	14	21	21A
ARGENTINA	21A	14	14	7	7	7	7B	14	21	21A	21A	21
AUSTRALIA	21A	14A	14	14	7A	7	7B	7	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14	21	21A	21A	21
ENGLAND	7B	7B	7	7	7	7	7B	14	21A	21	14	14
HAWAII	21A	21	14	7	7	7	7	7	14	21	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	21A	14	14	7B	7B	7	7	7	7	7B	14	21A
MEXICO	21	14	7	7	7	7	7	7A	14	21	21A	21A
PHILIPPINES	21A	14A	14	7B	7B	7B	7	7	14	14	14	21
PUERTO RICO	21	7A	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	14	7	7	7B	7B	7B	7B	14	21	21A	21A	21
U. S. S. R.	7	7	7	7	7B	7B	7B	14	14	14	14	7B
EAST COAST	21	7A	7	7	7	7	7	14	21	21A	21A	21

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair
G = Good P = Poor * = Chance of solar flares

OCTOBER

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G/G	2 G/G	3 G/G
4 G/G	5 G/F	6 F/P	7 F/F	8 F/F	9 F/F	10 G/F
11 G/G	12 G/G	13 G/G	14 G/F	15 G/F	16 G/F*	17 F/F*
18 F/P*	19 F/P	20 G/F	21 G/G	22 G/G	23 G/F	24 F/F
25 F/F	26 F/F	27 F/F	28 F/F	29 G/G	30 G/G	31 G/F

Full Duplex Oscar Transverter

YAESU FTV-901R

Tired of compromise in your VHF/UHF operating? Does your "compact" multimode rig leave something to be desired in the selectivity department? With the Yaesu FTV-901R VHF/UHF Transverter, the superb capabilities of your FT-901/902DM or FT-101ZD can be extended to the 50, 144 or 430 MHz bands!

Multiband Design Philosophy
The FTV-901R comes equipped for operation on the 144 MHz band, with 50 MHz and 430-440 MHz modules available as options. Power input is 20 watts on all three bands.

Duplex Satellite Operation
For satellite operators, three satellite bands are provided, allowing full duplex operation through the transverter for downlink monitoring. You can transmit on 2 meters while receiving on 10 meters or 70 cm, or transmit on 70 cm while listening on 2 meters. An external receiver is required (in addition to your FT-901/902DM or FT-101ZD) for duplex operation.

Rugged, Dependable Construction
The FTV-901R is a futuristic blend of FET, bipolar, and stripline techniques, providing high reliability, consistent power output, good noise figure, and outstanding rejection of spurious responses. And there's attention to the details, like the Type N connector for 430 MHz operation.

Worldwide Power Capability
Equipped for operation from supply voltages of 100/110/117/200/220/234 VAC, the FTV-901R won't become obsolete if you move to another country. The transmit drive requirement of 3V RMS at 28-30 MHz makes the FTV-901R compatible with many older Yaesu transmitters.

Repeater Split Capability
The FTV-901R comes equipped for repeater operation on the 6 and 2 meter bands. For 6 meters, 1 MHz split is provided, while 600 kHz split is provided on 2 meters. Take full advantage of the FM capability on your FT-901/902DM or FM-equipped FT-101ZD Mk III.

FT-901/902 Line of Accessories
Other high-performance accessories for your FT-901/902DM station include: the FV-901DM Synthesized Scanning VFO; YO-901P Multiscope with Panadapter; and the FC-902 160-10 Meter Antenna Tuner. See your dealer also for details of the YR-901 Code Reader and SP-901P Speaker/Patch.

For top performance on 1.8 through 450 MHz, Yaesu has the most complete line of transceivers, receivers, and accessories in the Amateur industry. Yaesu products are backed by a nationwide dealer network and two factory service centers for your long-term service needs. So when it's time to upgrade your station equipment, join the thousands of hams that are tired of compromise — join them by investing in Yaesu!

YAESU

The radio.

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Top-Notch.

VBT, notch, IF shift, wide dynamic range

TS-830S

Now most Amateurs can afford a high-performance SSB/CW transceiver with every conceivable operating feature built in for 160 through 10 meters (including the three new bands). The TS-830S combines a high dynamic range with variable bandwidth tuning (VBT), IF shift, and an IF notch filter, as well as very sharp filters in the 455-kHz second IF. Its optional VFO-230 remote digital VFO provides five memories.

TS-830S FEATURES:

- **160-10 meters, including three new bands**
  Covers all Amateur bands from 1.8 to 29.7 MHz (LSB, USB, and CW), including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz.
- **Wide receiver dynamic range**
  Junction FETs (with optimum IMD characteristics and low noise figure) in the balanced mixer, a MOSFET RF amplifier operating at low level for improved dynamic range (high amplification level not needed because of low noise in mixer), dual resonator for each band, and advanced overall receiver design result in excellent dynamic range.
- **Variable bandwidth tuning (VBT)**
  Continuously varies the IF filter passband width to reduce interference. VBT and IF shift can be controlled independently for optimum interference rejection in any condition.
- **IF notch filter**
  Tunable high-Q active circuit in 455-kHz second IF, for sharp, deep notch characteristics.
- **IF shift**
  Shifts IF passband toward higher or lower frequencies (away from interfering signals) while tuned receiver frequency remains unchanged.
- **6146B final with RF NFB**
  Two 6146B's in the final amplifier provide 220 W PEP (SSB)/180 W DC (CW) input on all bands. RF negative feedback provides optimum IMD characteristics for high-quality transmission.
- **Built-in digital display**
  Six-digit large fluorescent tube display, backed up by an analog dial. Reads actual receive and transmit frequency on all modes and all bands. Display Hold (DH) switch.
- **Adjustable noise-blanker level**
  Built-in noise blanker eliminates pulse- type (such as ignition) noise. Front-panel threshold level control.
- **Various IF filter options**
  Either a 500-Hz (YK-88C) or 270-Hz (YK-88CN) CW filter may be installed in the 8.83-MHz first IF, and a very sharp 500-Hz (YG-455C) or 250-Hz (YG-455CN) CW filter is available for the 455-kHz second IF.
- **More flexibility with optional digital VFO**
  VFO-230 operates in 20-Hz steps and includes five memories. Also allows split-frequency operation. Built-in digital display. Covers about 100 kHz above and below each 500-kHz band.
- **Built-in RF speech processor**
  For added audio punch and increased talk power in DX pileups.
- **RIT/XIT**
  Receiver incremental tuning (RIT) shifts only the receiver frequency, to tune in stations slightly off frequency. Transmitter incremental tuning (XIT) shifts only the transmitter frequency.
- **SSB monitor circuit**
  Monitors IF stage while transmitting, to determine audio quality and effect of speech processor.

More information on the TS-830S is available from all authorized dealers of Trio-Kenwood Communications 1111 West Walnut Street, Compton, California 90220.

KENWOOD
...pacesetter in amateur radio

Matching accessories for fixed-station operation:

- SP-230 external speaker with selectable audio filters
- VFO-230 external digital VFO with 20-Hz steps, five memories, digital display
- AT-230 antenna tuner/ SWR and power meter
- MC-50 desk microphone

Other accessories not shown:

- TL-922A linear amplifier
- SM-220 Station Monitor
- PC-1 phone patch
- HC-10 digital world clock
- YG-455C (500-Hz) and YG-455CN (250-Hz) CW filters for 455-kHz IF
- YK-88C (500-Hz) and YK-88CN (270-Hz) CW filters for 8.83-MHz IF
- HS-5 and HS-4 headphones
- MC-30S and MC-35S noise-cancelling hand microphones

Specifications and prices are subject to change without notice or obligation.